THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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## 1908—1909.

THIS being New Year's morning, we may very appropriately let our first words to the electrical profession and industry be a message of good wishes for a period of prosperity during 1909.

Most of our readers who are in positions of manufacturing or trading responsibility will to-day be starting a new account. But they will for some weeks to come also be looking back through the books, analysing the affairs of the past year and reducing their net results to pounds, shillings and pence profit—or loss. Let us hope that the firms who find the latter to be the outcome will be few. There always will be some—there are in every department of trade. We all devoutly trust that the new year has better times in store for those who wish for them and who consistently and persistently endeavour to produce them as well. For a number of large manufacturers the year has been one of pre-occupation with schemes for financial rehabilitation—to these we wish a period of less hampered and therefore more enterprising progress. We believe—Manchester Electrical Exhibition might be cited as illustrating what we are about to say—that there are at present among us ample forces to enable the British electrical engineering industries to work out their own salvation without the application of quack remedies. The principal difficulty of the year appears to have been due to the lack of a proper understanding between our own manufacturers, and no doubt those directly concerned will keep pegging away in this direction until something tangible results to the benefit of the industry. This is especially desirable in the works installation department, which has now assumed a position of great importance, affording large contracts for generating and motor plant and apparatus—though too often at low prices. The year 1909 will no doubt see continued advance in this class of business, and we trust that better prices will prevail, for it were a thousand pities for so promising a field to be spoiled practically at the commencement.

To review the events of the past year in detail would occupy more space than we can spare, and would be tedious to the reader; we may, however, comment very briefly on the leading features of the year's record.

In the department of electric lighting, the growing popularity of the tungsten lamp is rather a process than an event; the newcomer has thoroughly established its position as the most efficient and long-lived incandescent lamp for ordinary use that has yet appeared on the market, and its general adoption will exert a profound and all-pervading influence upon future developments. In dynamo design the commutating pole has continued to gain in favour, and has brought about a fundamental change in the conditions controlling the output of dynamos and motors. Turbines have not materially advanced, but the influence of Continental designs is making itself felt in various directions; on the whole, generating station practice and the distributing

system have not experienced any special tendency to modification, though the factors mentioned above must be reckoned with in future.

We must not omit to mention the final rejection, for financial reasons, of the proposal to supply London with electricity from one big station, which has been the sport of successive Parliaments for years past; nor the grant of powers to the London companies to organise their various systems so as to facilitate the supply of energy under more economical and uniform conditions than at present, with the London County Council as the purchasing authority in 1931.

In electric traction, the most noteworthy event has been the opening of the single-phase section of the Midland Railway for public use; we hope it will shortly be followed by the much more important undertaking of the London and Brighton Co. in South London. The Brakes Reports are fresh in the memory of our readers.

The Radio-telegraphic Convention came into force in the summer, and appears to be working smoothly and beneficially. Wireless telephony has taken practical shape on a small scale, and the Atlantic has been successfully spanned by the Marconi Co. in real earnest this time.

On the whole, the record is not unsatisfactory, having regard to the slackness of trade generally; if that of 1909 is as good, we shall have no cause for complaint.

## THE REVOCATION OF PATENTS.

We gave particulars in our last issue of the first application which has been made for the revoking of patents under the Act of 1907. In the absence of reasons justifying a contrary result, the Controller revoked two patents granted in 1900 to Ludwig Hatschek for the manufacture of imitation stone slabs and tiles. The application was made by a Mr. Charles William Zerenner, and was originally limited to one patent (No. 22,139 of 1900), but by agreement between the parties, a subsequent application filed in respect to No. 6,455 of 1900, was consolidated with the original application. It would appear that Mr. Zerenner had no intention to embark in the manufacture of the patented articles, but he stated that they could be commercially manufactured in this country, and that he had found people to engage in such manufacture. The decision of the Controller has given great satisfaction in many quarters, and is generally regarded as a material contribution to the development of British industries. Sir Joseph Lawrence, whose interest in the subject is well known, writes in the *Times* of Christmas Day, expressing gratitude to the Controller, but calling attention to the fact that "two or three, or even a dozen revocations of patents, are but as a drop in the bucket compared with the number that ought to be revoked," and urging the importance of firmly enforcing the provisions of the Act. It is but reasonable to expect that those who actively participated in the planting of the Act should look favourably upon its first fruits without very mature examination, but when the satisfaction to which we have referred is expressed in independent quarters, it seems to us that it may be advantageous to suggest that the subject requires more deliberate consideration than it has yet received.

We should like to know something about the relationship of the parties. If Mr. Zerenner is not a trade rival of Mr. Hatschek, what is his interest in the revocation of the patents? Is he a user of the patented article? He won his case and obtained a contribution towards his costs, but his application involved a risk of loss which, it is to be presumed, was undertaken for some business purpose, and not solely from a desire either to injure Mr. Hatschek or to benefit English manufacturers at large. It would appear that the defence was weak, and, on the facts disclosed, the decision of the Controller was reasonable.

But is it quite certain that even if substantial justice has been done between the applicant and the patentee, no injustice has accrued to third parties? And is it not conceivable that in some future applications for revocation there may be advantage in giving a *locus standi* to some officer equivalent to the King's Proctor in another Court? It was stated that the English trade was reserved to a Belgian manufacturing company. There are other manufacturers under the patents in France and Germany. The revocation of the British patents will throw the British field open not only to British makers, but also to the French and German makers. The British consumer may benefit by lower prices through the competition of all the foreign companies; but is there any particular cause for pride or satisfaction in the operation of a British law which, for instance, transfers to a German company who paid no consideration for it a trade which had been acquired, on the strength of British Government guarantee, by a Belgian company who had paid consideration for it? Was it for this that by the Act of 1907 the nation was laid open to an accusation of bad faith?

It must always be remembered that the granting of a patent was not in its origin intended to be, nor has it been in its operation, solely for the benefit of the patentee. It was a free bargain between an individual and the State. At a time when the dissemination of information was more restricted than now, the production of some commodities might have been continued for an indefinite period by a secret process involving the possibility of a prolonged monopoly inimical to the interests of the State, and the State consequently proposed to the owner of the secret process that he should disclose his secret in return for a guaranteed monopoly for a limited period. There is no obligation on an inventor to take out a patent if by any other means he can secure a monopoly of supply, but the individual who attempts such a method runs the risk that at any moment his secret may be discovered, and competitors spoil his market. Instead of incurring that risk he prefers to take the State into his confidence, disclose the details of his process or manufacture, and obtain the State's protection for his monopoly for a limited period. It was on the basis of such a bargain that in 1900 Ludwig Hatschek filed particulars of his invention on the undertaking of the British Government that he should have a monopoly for 14 years. Without making any new bargain with Ludwig Hatschek, the British Parliament in 1907 added a new condition to the continuance of Ludwig Hatschek's monopoly, and in 1908 the officer appointed to administer the Parliament's Act has decided that, in accordance with such Act, the 14 years' monopoly given in 1907, in exchange for information, shall be determined without consideration to the patentee, and the invention will be confiscated unless the decision of the Controller should be reversed on appeal to the Courts.

The provision for compulsory manufacture might, with perfect fairness, have been coupled to the grant of any new patent. The advantages assumed to accrue to British manufacturers would have been in part delayed, but it would not

have been possible as now for the foreign inventor to allege that the Government of the United Kingdom of Great Britain and Ireland had failed to carry out a bargain to which it was a party. It is certain that the nation did not lay itself open to this damaging criticism for the purpose of transferring a trade from one foreign country to another foreign country.

The Act was passed with the idea of developing home manufactures. Let us consider the present case from that standpoint. It was stated that the consumption in the United Kingdom represented one-sixth of the total quantity manufactured. Possibly the merits of the article have not been adequately made known. Manufacturers may see for it a considerable demand, but any one manufacturer will stimulate the trade without such security as a patent would give him. He is open to the competition of foreign producers who have greater experience and greater outputs than he has. In the event of his success in the international competition, he is certain of home competitors. For an article of widespread use he may readily embark upon manufacture, whilst for one of but limited demand he will be likely to hesitate. Is it not, therefore, quite probable that the revocation of Ludwig Hatschek's British patents will act unfairly on the Belgian company without developing British manufactures in the way so confidently assumed? On the other hand, if the invention were of real value and its use were to grow, is there not reason to believe that its manufacture here, as a patented article, would naturally arise on the stable foundation of purely economic conditions?

Prior to the Act of 1907 the essential difference between our own Patent Law and that of other European nations was that we protected brains without distinction, whilst other nations only protected brains when the muscles of their own inhabitants were employed in the preparation of the resulting products. The passing of the Act is an indication that in the opinion of the Legislature we had imposed upon ourselves a self-denying ordinance inimical to the progress of the nation. It is certain that we cannot afford to lose opportunities of immediate advantage in international competition, but it is yet early to assume that the change in policy will attain the desired end. The advantages of broad-minded policies may be very indirect, but they are none the less real, and future years only can reveal whether the progress of invention and the development of manufactures resulting therefrom will be facilitated or retarded by the new policy. In this matter, in common with the somewhat unfortunate trend of thought of the time, public attention is centred on one aspect only, the manufacturing value of a patented article, to the exclusion of its value in use. We must take care not to be unduly impressed with the Estate Agents' communiqués, the plaudits of the departmental politician, or the *ex parte* statements of the agitators for patent reform. The gratification which we all feel at any development in the home manufacture of patented articles should not blind us to the fact that measures such as the compulsory manufacturing feature of the Act of 1907 have a way of leading to disappointments. Few Acts were more justified in intent than the Merchandise Marks Act, and few have done so much harm to British trade. The Merchandise Marks Act provided a remedy for a serious injustice to British manufacturers, but it was expected by its promoters that apart from its avowed purpose, it would indirectly afford a stimulus to British trade. The contrary effect resulted not so much from flaws in the Act, as in the method of its administration.

The family resemblance both in respect to the avowed objects and the expected indirect results between the compulsory manufacturing feature of the Patents Act, 1907, and the Merchandise Marks Act, are so obvious as to suggest the advisability of not forming hasty conclusions as to its operation and also the desirability of weighing very carefully any claims which may be put forward for rigid enforcement, additional stringent legislation, and so on. These are the invariable accompaniments of short-sighted agitation. Before we begin turning screws, let us be more sure than we are at present that the expected results will follow.

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**Imperial Communications.**

WHILE the advantages to be gained by facilitating communication between the various parts of the British Empire are indisputable, and have been urged in our own columns from time to time, it is to be regretted that some, at any rate, of the daily papers should permit most absurd propositions to appear in their pages—statements which indicate not only lack of knowledge of the technicalities of submarine telegraphy, but also the absence of what we have a right to expect from all sections of the Press, technical or lay—namely, common sense.

The demand for reductions in cable rates is in many cases reasonable, and in the past has resulted in liberal concessions on the part of the companies controlling the cables—with material benefit to themselves, due to a more than proportional increase in the traffic. Writers in the lay Press, however, unfortunately fail to realise that the carrying capacity of a cable is a quantity strictly limited by physical restrictions which it is at present impossible to overcome, and they argue in favour of the drastic cheapening of cable communication, the popularisation of the service, and the "constant, instantaneous interchange of views upon all subjects between all portions of the Empire" (to quote the Imperial supplement to the *Standard*) just as though such a thing were possible, and were only hindered from realisation by the obstinacy and greed of the companies. "If cheap cable communication cannot be obtained by any other means," says our contemporary, "there must be no shying at State ownership of the lines." But how would this help them to attain the end desired? State ownership cannot override physical facts. An Atlantic cable, for instance, cannot be made to carry more than 50 or 60 words a minute, or if duplexed, about 100 words a minute. Yet, we are told, "it should be possible for the newspapers in every British State to print and discuss each day the items of news and questions of public interest which are dealt with at the same hour in the London Press!"

"At the same hour" is good; has the writer forgotten that there is not a single British possession, except on the Gold Coast, on the meridian of Greenwich? Apart from this however, and even supposing that the tittle-tattle with which the daily Press is filled nowadays would be of interest to our Colonial brethren, how could the vast conglomeration of matter be handled by the cables in the time available? It could not possibly be dealt with during the hours of business, without dislocating the commerce of the world—for it must be borne in mind that not only British messages pass over British cables.

Such suggestions are futile and Utopian. Reasonable reductions in the tariffs may be obtained, and there is undoubtedly scope for a service of deferred telegrams, which can be sent at times when the cables are otherwise disengaged, and which will be none the less effective for a few hours' delay. But let us in all things be reasonable.

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## PARIS TELEPHONE SERVICE RESTORED.

In our issue of September 25th we gave some particulars of the fire at the Central Exchange of the Paris telephone system on the previous Sunday (September 21st), resulting in the destruction of the whole building, with its elaborate and costly contents, and the consequent cessation of telephonic communication in that section of the city. The problem before the authorities responsible for the re-establishment of communication was a very serious one. It was impossible to render the destroyed premises available for use promptly, and it was in every way desirable that the exchange should be re-erected near thereto, so as to take advantage of the underground construction radiating from that point. The supply of apparatus, whether of a temporary or permanent character, was another very important matter to settle.

Fig. 1.—Paris Telephone Exchange; Burnt Out, September 21st, 1908.

Between the destroyed building and the Central Post Office there was an open space, which suggested itself to those concerned as affording an excellent opportunity for the erection of a suitable building for carrying on the exchange work. A decision on this point being arrived at, the supply of apparatus had to be taken in hand.

To restore the service in good condition and with the least possible loss of time was the aim of the authorities. The manufacture and erection of the considerable quantity of apparatus required is a great work, even when ample time is allowed, but becomes still greater when done against time. We understand that one local manufacturer had an order for switchboards in hand, which were able to be utilised, and their completion was hurried forward with all the energy and resource which might be confidently expected. Another portion of the work was carried out under circumstances which call for more detailed mention. An order for central-battery apparatus was placed with the Société de Materiel Telephonique (G. Aboilard & Co.) on September 29th. This order comprised a 10,000-line equipment with provision for 120 "A" operators and 90 "B" operators, which was to be delivered and connected up ready for operation in two months under a heavy penalty. Such a task would probably be impossible for any one factory and local organisation, but Messrs. Aboilard & Co. were fortunately able to rely upon the ready help of the Western Electric Co., with which concern they are in association, so that the factories at Chicago and London were able to contribute towards the speedy restoration of the Paris service. The "B" boards were ordered by cable from

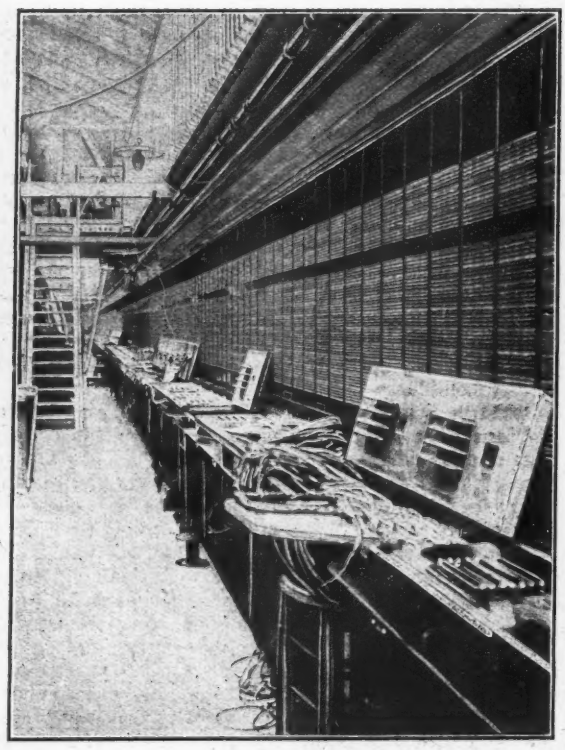

Fig. 2.—Switchboard being Fitted in Temporary Building, November 24th, 1908.

Fig. 3.—Switchboard Fitted and Operators at Work, November 30th, 1908.

Chicago, were manufactured; their 300,000 jacks connected up, and on October 23rd were dispatched to New York for shipment by the ss. *Provence* on the 29th; these were delivered in Paris so as to permit the mounting to begin eight days later, together with the balance of the order which had been made at the Paris factory.

Whilst the switchboards were being constructed in the various factories, the building was being made for their reception. The lack of time here again led the authorities concerned to seek the quickest means of providing the necessary accommodation. The materials of the last Automobile Exhibition in the Invalides Square were ready to hand, and were utilised for the new exchange. The building is 70 metres long and 11 metres wide. It comprises a ground floor and two galleries. The "A" boards are mounted in the galleries, and the "B" boards on the ground floor. The new equipment was put into operation on November 30th.

Our illustrations show in fig. 1 a view of the destroyed exchange on September 21st; in fig. 2 the new boards in process of erection (November 24th); and in fig. 3 the new boards in operation (November 30th). The Paris Telephone Administration is to be congratulated on the promptitude with which this work has been carried out, though only those familiar with the elaborate detail of switchboard work will be able to realise its magnitude.

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Electrical Driving in Cotton Mills.

Replying to "Textile Engineer," who, like myself, appears to be willing to look on each side of this question, I would say that his figure of 25 per cent. of geared mills does appear to me rather high. There have been few geared mills built during the last 23 years. It may not be out of place to point out that rope driving coincided with the wider introduction of machine-moulded wheels, and very bad these early wheels were. My own millwright's training was with gearing made from properly-designed, correctly engine-cut patterns. The machine-moulded wheels, as I knew them, would be a full $\frac{1}{8}$ in. out of pitch in a 4-in. pitch. They sealed the doom of the geared mill. But good gearing was reasonably silent, and required 5 to 10 per cent. less power than ropes. Ropes won the day by virtue of bad wheels and fly-wheel energy. Perhaps "Textile Engineer" may recollect when "Crawford" No. 1 was launched about 24 years ago, that a geared mill of the same number of spindles, only a few yards away in Crawford Street, gave the same output for much less I.H.P. It is, perhaps, an argument for electric driving that its greater absorption of power need not necessarily shut it out of competition any more than ropes were shut out, though they required more power than gearing. Gearing also required less space—no rope race, for example. It was killed by the noisy and incorrectly-shaped teeth which marked so many of the early machine-moulded wheels. And when I spoke of old mills I did not mean to include the better class of geared mills. "Textile Engineer" speaks of mills not being built on excessive areas of land, and invites me to Oldham. I was there recently, and in five of the other principal mill centres with which I have been more or less familiar since a time when 100 per cent. of the mills were geared, and I did not then notice the economy in site areas of which he speaks. I also note what he has to say as regards the B.B. system of frame driving. No opinion was expressed by me on this system except that if successful it pointed a direction in which electrical men might be better able to find success than in the doubtful displacement of a few wheels on rope pulleys by more expensive motors. In scorning the application of a separate motor to each ring spindle, the scorn is decidedly discounted by the ironical suggestion to apply a motor to each line of rollers — a very different matter. It is possible to apply a separate motor to each spindle: there is room for it in the pitch of the spindle, and the power to drive a spindle is a mere nothing; and I am told that the motors are so simple that their cost should be a mere trifle for a cotton machinery maker to build. It is not even mechanically possible to apply a motor to each line of rollers, for they require considerable power, the front line is heavily weighted and the C. to C. distance is less than half that of the spindles. Not that even a separate motor to a whole ring frame particularly appeals to me unless the B. B. system can be advantageously applied. Destroy my assumption that there is something in this, and the rope drum takes its premier place again as regards any yet applied system of electrical driving. To me it seems crude to dump a motor down on the floor and so to drive a ring frame, a speed frame, or even a card. If electrical systems are to come into general use the motors must be built into the frames. Because there are ring frames in some weaving sheds does not to me afford any more light on the word "flexibility," presumably the ring frames are not mixed up among the looms. "Textile Engineer" wants to know how to apply a 3,000-R.P.M. turbine to mill driving. Years ago, as he may find in the columns of the ELECTRICAL REVIEW, the large engine was foreshadowed by me as likely to win the day as compared with the little high-speed engines on which electricians pinned their faith. The abuse poured on my suggestions did not prevent them proving true. Similarly to-day I do not believe that high velocity is necessarily incidental to the turbine. The turbine was primarily designed to drive high-speed dynamos, but high speed is not the last word.

Let "Textile Engineer" consider the question on the lines of larger pulleys on the machines and smaller pulleys on higher speed shafting, the latter carrying larger rope pulleys driven by smaller pulleys on the turbine shafts, and possibly ropes smaller than the present $1\frac{1}{2}$-in. minimum. It is all a question of a suitable compromise of conditions, no more difficult than those that have been arrived at in all mill gearing for a hundred years past. But we should not glue ourselves fast to the idea that a turbine must run at 3,000 R.P.M. A reasonably high speed could still be allowed if the present ratio of shaft speed to machine speed were changed three-fold, or even twice, and if the rope drum ratios were several times reversed as from 5 : 1 to 1 : 2. Even with these moderate and perfectly practicable alterations, one could change a 60-R.P.M. engine to an 1,800 R.P.M. turbine.

But while we are fighting over these trivial matters, are we not, as "Textile Engineer" suggests, neglecting the more important question of the gas engine? Whether applied to the simple rope-driving, to electrical driving at the mill itself or to electrical driving from outside, the gas engine looks likely to succeed. Indeed, as regards the success of long-transmitted electricity, there appears to me but little prospect except through the agency of gas power, generated it may be by the blast furnace gas we now waste so very foolishly.

"Textile Engineer" tries to show a case for flexibility on the basis of its use in badly-balanced factories. I have too high an opinion of the general balance of Lancashire mills to place much value on any advantage to be got out of this overtime, &c. Nor does there seem any advantage in running half the machinery in a mill, as compared with the running of the whole of it for half the time each day, or for half the week; but such conditions are mere temporary incidents. If they were so permanent as to warrant their use in argument, Lancashire might shut up shop at once. Let us at least discuss the driving question on a rational basis such as will best appeal to spinners; and as the question of turbines has been raised, will "Textile Engineer" add some light and tell us what has been done so far with turbine-electrical driving, tell us the hours run by the turbines, and the hours run by the spindles, the I.H.P., or the units or other power used per 10,000 spindles and generally a few actual facts of comparison between different methods of driving?

When I spoke of old mills, be it understood that my reference bore less on the matter of their system of gearing, than upon their steadiness of driving. Any fault of the geared mill lay in the slow speed of the engine and the

insufficient fly-wheel effect. Thus a pair of engines that would indicate 800 H.P., would trundle slowly round with a fly-wheel of a total weight of only 20 tons. This was insufficient, as events proved.

As regards the empty shells he so kindly offers me, presumably he is aware that these empty shells are empty because the machine makers have been too busy to fill them; and as to his pessimistic views of the future, presumably also he knows that, just previous to the late boom in spinning, Lancashire was declared to be dead and too poor to bury itself, and with too many new mills to find work. Yet they all did find work, and so did many more, as they will do again.

**W. H. Booth.**

London, S.W.,
*December 26th*, 1908.

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I have read Mr. Booth's letter in your issue of the 11th inst., but, generally speaking, cannot agree with what he says. From the figures in the top left-hand corner of page 999, I learn for the first time that he dealt with new mills only in his article. I certainly had old mills very much in my mind when I wrote, and these offer a far greater and, from the point of view of results, better field for electrification than the former.

I have made further inquiries regarding the capital cost of the various schemes Mr. Booth discusses, and must adhere to my criticism of his figures. However, no good is likely to be derived by further discussion of these, as any millowner wishing for this information will, no doubt, obtain competitive estimates to suit his own particular case, and so get an actual comparison.

*Coal Bill.*—I cannot present the figures Mr. Booth asks for, and which, it must be recognised, are very difficult to obtain, as to make a fair comparison it is an essential that the conditions in both cases are identical.

I lay no exclusive claim to the turbine for electric work, although up to now I have never come across a turbine of any size used for other purposes excepting blowing and marine propulsion. It is true that one firm have made machines up to, I think, 300 H.P. for use with rope driving, but on the larger ones they turn to the electric generator. I know of makers who are now experimenting with reduction gears for the larger powers, say, 500 to 1,000 B.H.P., and hope to see a manchine produced before long suitable for the purpose in question. The problem, however, is far from being so simple, as one would imagine from Mr. Booth's letter.

*Lighting.*—I have inquired concerning seven mills electrically-driven by means of alternating current, and find that all use the same supply for lighting with entirely satisfactory results. If, however, a separate set is desirable, why not allow for this in the case of the rope-driven mill? Or if a generator driven from the engine is considered satisfactory, surely a machine coupled to the end of the turbine shaft would be equally as good, or a cheaper method would be to put some margin in the exciter and utilise this.

1. *Flexibility.*—I know that in one case at least it was considered of value to divide the mill into independent halves or some other porportion, so that either would run at full efficiency independently of the other, a public supply of current being used. Mr. Booth's sketch of ring frames of all lengths placed at various angles is, of course, ridiculous. In old mills the flexibility of the electric drive has been found of considerable value, and has been the means of getting rid of many awkward drives.

2. *Flexibility of Running.*—With the rope drive what happens when a rope gives out? Why, the whole mill is shut down temporarily, but with a properly arranged electric drive there is no fear of a similar occurrence. Mr. Booth in his article says, "One thing is certain, both in mechanical and electrical methods, the machines will run practically as regularly as the prime mover," and goes on to say that the interposition of ropes will help to improve the turning if anything. Careful tests with Dr. Horne's tachograph have shown that this is far from the case.

3. I do not agree, apart from the reason given under (2). There is no doubt that the turning moment of the steam turbine is far steadier than can possibly be obtained with any reciprocating engine. The torque on the motor shafts is of course constant.

5. I need say nothing more regarding the disadvantages of the rope race; they are so obvious. The electric drive not only gets rid of this expensive and objectionable feature, but in addition, the shafts can be made of convenient length, and the motors placed in the centre of these without occupying any floor space, and this minimises all torsional disturbances.

As regards the latter half of Mr. Booth's letter, there is nothing I need say. As already stated, transformers are invariably supplied by the sellers of current and the consumption is usually measured on the low tension side. I have no desire to shove any expenses on to the seller of current except those he rightly bears. I would not cut 8 per cent. of my spindles off a ring frame, preferring to group the machines (except under special circumstances).

**G. L.**

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### Silence is Golden.

Once upon a time (not very long ago) a chief engineer of one of our Scotch municipal electricity works made a most profound remark, which showed up the extent of his knowledge to his subordinates in a most painful manner. I will call it a silly remark, although ignorant would be the proper word, as it was made in dead earnest and not as a joke, as the circumstances will show. This chief was one day informed that a 50-ampere fault had developed on the positive, and, calling for his mains superintendent, he gasped: "Don't you know, So-and-So, that there is a 50-ampere fault on the + side, and this means that 150 amperes are going to earth." The mains superintendent naturally could not follow this logic, and said "No." Then the "great man" rose (or sunk) to the occasion, and explained that on a three-wire network there were three "legs," so that although the fault was apparently only 50 amperes, the formula should be "50 amperes × 3 legs = 150 amperes! (Exit mains superintendent.)

The cream of the whole affair was that there was no fault on at all. Therefore, I recommend to all men who have been unjustly placed in that state of life into which it has pleased our worthy Councillors to call them, that "Silence is golden."

**A. J. Abraham.**

Electricity Works, Cambuslang,
*December 22nd*, 1908.

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### Cheap House Wiring.

Referring once more to "E. C. S.'s" letter under the above heading in your last issue but one, and also to Mr. W. Perren Maycock's letter in your last issue—he expresses the opinion that a man who allows a £10 note to stand between him and the electric light is, to put it mildly, an unmitigated, hopeless, benighted, stodgy ignoramus, and wonders at the darkness of his mind which prevents him from seeing what increase of personal energy, lessened depreciation, saving of time and temper, better light, low lighting bills, and safety mean.

Then in five big paragraphs he pours out the vials of his wrath on gas, gas fittings, gas pipes, gas mantles, gas fitters and all their works. And recounts the gas storms induced in the master of the house, himself, baby, help, dog, and so on; and sees visions of more gas storms and explosions when the ancient and corroded chandelier gives out, and the whole household are blown down to Heligoland. Heligoland is in a downhill direction, isn't it? And isn't it also the Mecca of all gas fitters and other sorts of burners, Bray's and bat's wing, argand, and incandescent!

Now, I wish to point out to Mr. Maycock that he is himself an unmitigated, hopeless, benighted, stodgy ignoramus, or something very much like it, if he has not found out what is being done nowadays with gas.

It is beyond question the best, the most convenient, healthful, pleasant, pure, cool, and inexpensive light ever put into a house after daylight was first introduced.

Since it superseded oil lamps here a year ago, the master of the house, myself, help, cat, and canary are prepared to *affirm*—we don't swear any longer—prepared to affirm that no better light can be had, and it comes from gas.

But we are not so lost in antiquity as to burn it in the house. We have a little shed in the garden, about 8 ft. × 6 ft., and we burn the gas there, in a nice little engine which drives a nice little dynamo, and generates electricity at 10 volts pressure.

This is carried into the house in the usual way, and not only lights the rooms as well as one could desire, but also rings the bells, and enables us (through the telephone) to order our breakfast before getting up.

And the cost—this is where it scores—the cost in gas for generating electricity for a week's lighting is less than we paid for the oil consumed in one oil lamp in our benighted days.

**T. J.**

*December 28th*, 1908.

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### Tramcar Meters.

In your editorial note on tramcar meters in your issue of December 18th, you mentioned the fact that at a previous date when you were advocating the use of time meters on tramcars, there was no manager who would have faced the expense of equipping his cars with watt or ampere-hour meters.

The fact that the Chamberlain & Hookham meters used by Mr. Spencer at Bradford paid for themselves in six months shows that this difficulty has been surmounted. You also question ampere-hour meters possessing sufficient advantages over time meters to be worth the extra expenditure. (We are makers of watt, ampere-hour and time meters for tramcar purposes, so that we hope our following remarks on this matter may be taken as unbiassed.) We have gathered from most of the principal tramway managers in the United Kingdom that the time meter does not go far enough in exposing faulty electrical and mechanical equipments, and it also introduces a special disadvantage in causing drivers to sacrifice every other consideration to that of speed; many cases of burnt-out armatures and damaged equipments have resulted from the driver's haste to get over the notches of his controller. No doubt time meters have loomed very largely in Continental practice, but the price and design of the motor meters with which they were in competition offer the probable explanation.

With reference to Mr. Gunz's statement, that Mr. Mozley is proposing to use time meters on all his cars, we understand that these will not be the only instruments used, but that watt-hour meters will be used along with them, and no doubt the two meters will be working side by side in the near future on the Burnley trams.

We should like to add that ampere-hour meters are far more commonly used on British tramways than you appear to appreciate in your Editorial note.

**Venner & Co.**

London, S.W., *December 29th*, 1908.

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### Fixation of Nitrogen.

Under the above heading in your issue of December 18th, page 1057, there is an article relating to the process and patents of Mr. Moscicki, of Fribourg, Switzerland, for the manufacture of nitric acid and nitrates from atmospheric nitrogen.

A paragraph therein is, unfortunately, misleading, necessitating this correction. It states that "a community of interests has also been concluded between the Aluminium Co., of Neuhausen, and the patent owners with regard to manufacturing under, or sale of, the (Moscicki) patents in other countries."

As the particular countries referred to are not specified, it has been incorrectly assumed from such paragraph, and to our prejudice, that the arrangements referred to relate to all European and foreign countries, and the British and Colonial possessions.

As we, and several English colleagues, are jointly entitled with Mr. Moscicki to his system for the countries set forth below, under special binding agreements settled and approved by counsel, and entered into so far back as March 10th and 14th, 1906, which have for nearly three years involved great expenditure of time and money on our part and that of our colleagues, we desire to say that the above statement "of community of interests," and the inference naturally drawn from it are quite incorrect.

The countries reserved to Mr. Moscicki under our said agreements with him and his company (the Société de l'Acide Nitrique) are :—Switzerland, France, Austria, Hungary and Russia, in which countries alone he is entitled to deal independently with his patents granted in them.

The countries expressly reserved to us and our English colleagues, to also exclusively deal with under the two agreements referred to, are :—Germany, Belgium, Holland, Great Britain, Italy, Greece, Spain, Portugal, Sweden, Norway, Denmark, Turkey, Africa, China, Japan, South America, and the United States of America, and Canada; as well as the whole of the Australian Colonies and New Zealand.

In respect of the whole of such last-mentioned countries we beg to say that no "community of interests" whatever has been concluded between us, our English colleagues, and the Aluminium Co., of Neuhausen; and we are the only persons exclusively authorised and empowered to carry out such negotiations, arrangements, and agreements, as we may deem necessary under the two said agreements for all such countries.

To prevent the public being further misled, we shall be obliged by your giving this correction as full prominence and publicity as the article referred to.

All communications relating to the process and patents for use in the countries last named are to be referred to us at our address.

**Shone & Ault.**

London, S.W., *December 26th*, 1908.

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### London County Council Turbines.

I have read with amusement the letter of Mr. G. Wüthrich, the manager in London of the Maschinenfabrik Oerlikon. He seems indignant because the L.C.C.—who obtain their funds from the pockets of the *British* ratepayers—have given an order to a firm of British manufacturers, rather than send it abroad (which so many narrow-minded Corporations have done), and thus do something to avoid reducing the working classes to obtaining a livelihood by charity and begging instead of work.

However, I may say I have the highest opinion of the work done by his company, and hope that Mr. Lloyd-George's new Patent Act, which is now in force, will compel some of our Continental friends, who are so anxious to obtain our orders, to come and start works in *our* country, and thus find employment for the British working man, rather than we should support him in the workhouse by the Poor Rate!

**Horace Boot,**
*Consulting Engineer.*

Electricity Works, Tunbridge Wells.
*December 21st*, 1908.

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### Transformer Switches for Metal-Lamp Installations.

In your issue of August 14th last, p. 261, you refer to the use of automatic switches for cutting out the transformers when no lamps are burning; and you further state that these are readily obtainable. If this is so, the makers do not appear to advertise them, for I have been on the lookout for this very device for some time. If the switch you spoke of opens the circuit by itself as soon as the current demand drops to zero, what happens when current is wanted again? Does it have to be put on by hand, or can it be operated electrically from a distance by a low-voltage current?

If the transformer open-circuit losses are proving serious, or if many supply authorities are illegally (as you point out) taking up the stand referred to, there seems to be an opening for a small electrically operated switch which may be put "on" and "off" from pairs of push buttons fitted at one or more convenient points in the house and operating with the electric bell current.

The transformer would usually have to be fixed in the cellars, or some other inconvenient place, where frequent journeys for the purpose of operating the switch by hand would never be tolerated by the average householder or his servants; and a clock-operated switch is obviously out of the question. I should be very glad to have full particulars of switches of the above description from the makers; and so also would many others of your readers, I should think.

Lastly, when switches (of any kind) are installed, it would clearly save a lot of trouble if the lamps in cellars and other dark places were fed at the full voltage, so as to be available at any time without having to switch on the transformer.

**W. Perren Maycock.**

[The automatic switch referred to cuts out the transformer, but leaves a solenoid in series with the lamp circuit; hence, whenever a lamp is switched on again, the solenoid is energised, and throws in the transformer. The switch needs no attention, and being "automatic," it, of course, is *not* operated by hand.—Eds. E.R.]

### Which is the Rational Method of Stoking?

In reply to "Radix" in your valuable paper of the 11th inst., I agree with him as to which is the rational method of stoking; I am quite sure that the overfeed method is the best—that is my experience.

It would be a grand apparatus that would give us engineers the results set forth in "Radix's" letter; what is wanted in a boiler house is more practice and less theory. We have had enough of theoretical ideas in the past, which have given us quite enough trouble.

"Radix" says I have had an unfortunate experience with one type; I think if he will look up my letter of November 26th, he will find that I have had many unfortunate experiences with machine stokers, some that I shall not readily forget.

So far as the settlement of the question is concerned, I am quite sure that I am on the right track this time, with the apparatus I now have working; it has passed my expectations, and has given me better satisfaction than all the other systems I have tried. The machine gives us no trouble, and does its work exceeedingly well; the mechanism is very simple, and the average fireman can get into the working of the machine in a very short time.

"Radix" is entirely wrong in saying that I have not seen the overfeed system properly worked; I may say that I am now seeing it worked properly on our boilers for the first time, and I should like to point out to him that our average consumption of coal is about 1,400 lb. per hour per boiler, with natural draught, and we have an average of 14 per cent. $CO_2$ for all last week in working hours, so I think "Radix" will be convinced that I have a good machine, and am also seeing the overfeed system worked properly.

There is just another point which I would like to add; that is, when my brother engineers go to inspect mechanical stokers in operation, let them ask the fireman to level up his fires and then allow the machine to work about three-quarters of an hour, leaving the mechanical stoker to do its own work; afterwards stop the apparatus and wait until the flame of the fire has gone down, then note where the fuel has been deposited; they will then see whether there is a big thick fire at the front and none at the back.

Seeing now that this much debatable topic has been taken up by stoker makers, I very reluctantly withdraw, as I can see no good purpose to be served by continuing this correspondence.

**Engineer.**

**Birkdale Lighting.**—The sections of new street lighting for experimental purposes will shortly be completed. The arc lamps in Weld Road are almost ready for use, and the first lamps of the new Osram installation in Liverpool Road have been switched on. These lamps are of 160 c.p. each. A 400-c.p. lamp of the same kind is to be erected. The experimental sections on the tramway route have up to the present given every satisfaction. If the tests conclude as satisfactorily as they have commenced, there is no doubt that the whole of the tramway route will be lighted in the same way.

## THE PARIS MOTOR-CAR EXHIBITION.

The eleventh annual motor-car exhibition in the Grand Palais, Champs Elysées, Paris, which closed its doors on December 13th, was once again a brilliant affair, for while the organisers had not gone to such extravagance in the way of internal and external lighting as in previous years, the building was, after dark, a blaze of light which rendered it a landmark from practically every quarter of the Ville Lumière. So far as the exhibition itself was concerned, it demonstrated anew the marvellous way in which the petrol car has practically ousted all its rivals, for out of the 573 vehicles on view, only four were electrically-propelled and five of the *mixte* or petrol-electric type, while this year the steam car was conspicuous by its entire absence.

Considerable interest was shown in the G.E.M. petrol-electric vehicles of the Société Générale d'Automobiles Mecaniques, of Puteaux, Paris, which are being made in various sizes including 10-14 h.p., 20 h.p. and 35-38 h.p. as regards pleasure cars, and 20

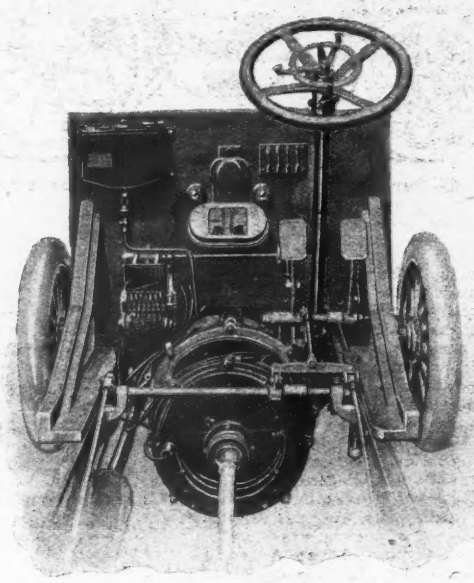

Fig. 1.—Forward Portion of Chassis of G.E.M. Petrol-Electric Car.

h.p., 30-40 h.p. and 40-50 h.p. for industrial and public service vehicles. The aim of the designer has been to present a car which offers no encumbering levers, no troublesome speed-changing device, no starting handle, no controlling organ—in fact, nothing but a steering wheel and the clutch and brake pedals. This ideal is obtained by the addition of a special dynamo-motor to the petrol engine (fig. 1). The latter can be of any standard pattern, one of the cars on view being fitted with the new "valveless" engine recently introduced by the Daimler Motor Co., Ltd., and built under the

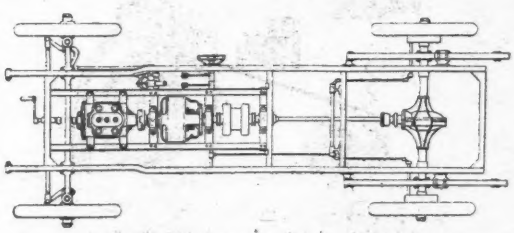

Fig. 2.—Plan of V.A.T.E. Chassis, Showing the Transmission System.

Knight patents. The dynamo-motor is located at the rear of the engine, the armature practically forming the fly-wheel; the field magnets are fixed and supported on the frame of the car. The final transmission is by a universally-jointed shaft and bevel gear to a rear live axle. Under normal conditions, that is, when running on level roads, the engine drives the car direct, the dynamo running idle after it has fully charged an auxiliary battery of 24 Tudor cells located at the rear of the chassis, and having a capacity sufficient to give 25 amperes at 50 volts for 45 minutes. When the engine is unable to furnish the requisite power to propel the vehicle, as on starting from rest, or when climbing steep hills, the dynamo is automatically converted into a motor, drawing current from the battery and adding its power to that of the engine. As soon as the petrol group is again able to take care of the car, the motor acts as a dynamo and recharges the battery, something after the style of the Raworth regenerative control. The speed of the car is regulated by controlling that of the dynamo by a lever on the steering wheel. There is also an auto-regulator for the admission of gas to the

cylinders, according to the speed of the dynamo. One lever on the steering wheel serves for starting and the backward motion, and a second one serves to regulate the speed. These and the two pedals above mentioned are all the mechanism to be seen. The system appears to be well thought out, and we understand that a motor-'bus of this type has been tried in Paris with successful results.

A new combination 10-H.P. petrol-electric vehicle known as the V.A.T.E. (voiture automobile à transmission electrique) was shown by M. G. Decolange, of Rue de l'Oasis, Puteaux, Paris. Looked at in

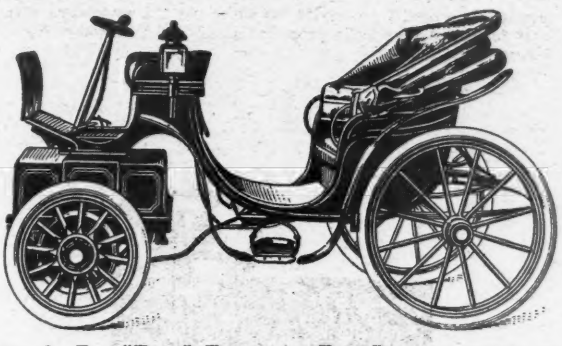

Fig. 3.—The "Fram" Electrical Fore-Carriage fitted to an Ordinary Victoria.

plan, fig. 2, the vehicle closely resembles a standard live axle car; in place of the usual gear box under the driver's floor board is a specially-wound dynamo driven directly off the engine shaft; in fact, the rotating field-magnets form the fly-wheel of the motor; the armature also rotates and is connected with the cardan shaft, which transmits the power through bevel gearing to the rear axle. The dynamo works in circuit only with a variable resistance which enables the power of the engine to be, as it were, geared down to suit the load on the vehicle—as, for instance, at starting and on steep hills. On level roads, when the car is travelling at practically the same speed as the engine is running, the armature and field magnets are mechanically brought into engagement, the whole acting as the fly-wheel of the motor, which latter then drives the car direct. The direct drive is controlled by a pedal, while a lever on the steering wheel controls the variable resistance, and enables any desired speed to be obtained.

The old idea of an *avant-train* or motor fore-carriage which can be applied to any horse-drawn carriage, by substituting it for the front wheels of the latter and so converting it into an automobile, is revived by the Société des Avants-Trains "Fram" of Paris (10, Rue Lafitte) and Rome. As shown in fig. 3, the fore-carriage is provided

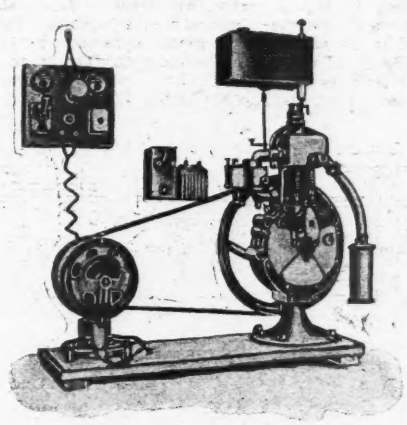

Fig. 4.—"Bijou" Electric Lighting Set.

with two electric motors, each driving through gearing one of the road wheels; the frame to which the front axle is attached also forms the support for the chest containing the battery of electrical accumulators, one charge of which is sufficient for a run of from 35 to 40 miles. The controller is adapted to give six forward speeds, one reverse motion and one electric brake. The company claim that one of their *avant-trains* can be utilised in connection with a victoria, coupé, or landaulet, the operation of detaching it from the one vehicle and attaching it to the other occupying but little more time than is taken up in transferring a horse from one pair of shafts to another. Judging from the photos displayed, a large number of the "Fram" fore-carriages are in use in Italy.

The only other electrical cars exhibited were those of M. Alfred Dinin, of Quai National Puteaux, Paris. The vehicles were of the victoria type intended for town and park use, and were similar to those displayed by the same firm a year ago. A single electric motor is used, this driving the rear axle through spur gearing.

In the accessory section, there were a large number of exhibitors of ignition apparatus, and a feature of this section was the range of new magnetos—mainly of the high-tension variety—which have been put on the market since this system of ignition replaced that by accumulators and coils on petrol motor-cars. The most popular make of magneto is the Simms-Bosch; others which are competing with it keenly include the Eisemann, the Nieuport, the Nilmelior, the Gianoli, the Unterberg and Helmlè and the Ruthardt. Makers of small accumulators, while doing less in the way of batteries for ignition purposes, find a counterbalancing business in the increasing demand for cells for lighting purposes, modern covered motor-cars generally being fitted with an installation of electric lamps for lighting up the interior. Messrs. Iglesis and Regner, of 32, Rue Reunequin, Paris, had on view an interesting little dynamo known as "La Magicienne," intended for lighting and ignition purposes, as well as for the mechanical starting of the petrol engines of motor-cars. The machine is arranged to be driven off the engine by suitable gearing; it is entirely self-regulating, and maintains the small battery of accumulators for lighting and ignition purposes in a fully-charged condition. To start the petrol engine, the dynamo is made to act as a motor, being supplied with current from the batteries.

Most of the principal builders of petrol motors are now turning out combined sets of engines and dynamos for electric lighting and power purposes, in addition to engines for use on motor-cars, among them being the Aster, Ballot, Gnome, and Mutel Companies. M. F. Robin, of 6, Rue Haxo, Paris, makes a speciality of what he terms the "Bijou Groupe Electrogène." This consists of a small water-cooled petrol motor driving by a belt a series-wound dynamo mounted on the same base plate (fig. 4). The set, which has a capacity of 250 watts, comprises a complete little switchboard, and a set of accumulators of either 55 or 110-ampere capacity at 16 volts; it is claimed to be well adapted for the lighting of farms, country villas, &c.

## THE L.G.B. AND MUNICIPAL ELECTRICAL ACCOUNTS.

The Epsom Urban District Council, requiring a small additional loan of £1,500 for electric lighting purposes, a Local Government Board inquiry is in progress, which affords an object lesson in the vexed question of municipal trading in electricity supply. The most interesting feature in the case is the apparent determination of the Inspector to have the accounts properly drafted and audited before dealing with the question of a further loan for the undertaking.

The inquiry commenced on December 15th. A full report of the proceedings appeared in the local journal, the *Herald*, on Saturday, December 19th. That journal, in a leading article, describes the proceedings as a "severe shock" to the officials of the Epsom Urban District Council, who, no doubt, were wholly unprepared for the searching investigation adopted by Mr. H. R. Hooper, M.Inst.C.E., the Local Government Board inspector. The ratepayers having apparently become accustomed to the skinning, like the proverbial eels, do not appear to have taken any active interest in the matter, and no doubt it was expected that the inquiry would be a formal affair, but Mr. Hooper took quite another view, and for the benefit not only of Epsom, but also of all other local authorities, he raised the whole question of the result of the trading and the financial position of the undertaking.

The engineer, Mr. H. F. Foster, had to bear the brunt of the Inspector's requirements and comments. "Where is the accountant?" inquired the Inspector, "it is most important he should be sent for." It seems to show how entirely the onus is thrown upon the electrical engineer, that on the occasion of an inquiry of this kind, concerning the financial requirements of the local authority, the accountant should be absent, the needed explanations being left to the engineer and the clerk to the board.

The Epsom electrical undertaking has not been a financial success from the commencement, and the ratepayers, who have had to provide the deficiencies from time to time out of the rates, must often have regretted that the supply of electricity was not left in the hands of one of the companies which offered to undertake it.

The Inspector appeared to be resolved upon ascertaining the cause of the loss in trading, and one cannot but sympathise with the engineer who when asked questions as to the accounts replied that "he had practically no time to get out the particulars asked for." The unfortunate electrical engineers are too often considered as servants-of-all-work, and their remuneration, like that of the domestic "general," is not based upon the highest scale.

During the discussion, interesting light was thrown upon the trading. The rates appear to have been drawn upon to the extent of £5,640 to cover deficiencies, and the want of success was attributed to "slow patronage of the current, and competing with the gas company," the remedy for which is obviously a vigorous educational campaign to teach the public that it is in their own interest to adopt the up-to-date methods for obtaining light, heat, cooking and power.

The gas companies are putting forth all the efforts possible to maintain their business, and they must be met with equal vigour. The engineer at Epsom complained that the undertaking was not supported by the Council generally—certainly a poor recommendation when the supporters of municipal electrical trading do not patronise their own business. "Do as I say, not as I do," is an unsound principle; better results come from another doctrine, viz., "Example is better than precept."

The Inspector put the financial question very clearly, when he said that he wanted to know whether what was being charged was sufficient or insufficient. Out of the revenue from public lighting, a proportion must go to repay fixed charges. He wanted to know what the proportion was, and to see what balance was left in respect of the cost of running the station, generation of current, cleaning, lighting, attendance, &c., and whether they were losing money on that. If not, they must see if they were losing money on the price of 5½d. per unit for private lighting. The engineer stated that he received 6s. per annum per 8-C.P. lamp, but he might have added that, with the substitution of the metallic-filament lamp, this revenue may be reduced by nearly one-half, and that the necessity exists, therefore, for considerably increasing the business, or his losses will be aggravated by the falling-off in his present returns.

The Inspector reminded the engineer of one of the financial disadvantages under which municipal trading is carried on, viz, that "an undertaking has to pay for the money with which it can be started." The local authority has no capital, and must borrow and pay interest, besides repaying the loans, hence the position at Epsom.

The loss, said the engineer, arises from "repayment of capital and interest, which exceeds our revenue," but the Local Government Board are not satisfied with this reply, or the ratepayers either, especially those who do not require, or cannot obtain, a supply of electricity, and do not appreciate the explanation that the losses arise from "the accumulated deficits of succeeding years, a deficit provided by the rate."

The Inspector adjourned the inquiry *sine die*, to enable the accountant to furnish the information necessary for arriving at the real financial position; meanwhile, it might be prudent if the Urban District Council ascertained the terms upon which their undertaking could be worked by taking energy in bulk from a company capable of supplying it, thus bringing their town into line with the modern system, and constituting their business for local distribution only. Even if this were done, the necessity would still exist for pushing the sale of electricity by publications, canvassing, exhibitions, lectures, and all the enterprising efforts of an active publicity organisation.

## PROCEEDINGS OF INSTITUTIONS.

### Output and Economy Limits of Dynamo-Electric Machinery.

By J. C. MACFARLANE and H. BURGE.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, December 10th*, 1908.)

(*Concluded from Vol. 63, page 1086.*)

#### ALTERNATORS.

THE output to be obtained from the armature of a synchronous alternating-current dynamo is not in any way limited by questions of temperature rise, but is entirely limited by the permissible value of the pressure rise from full load to no load when working on the maximum inductive load.

The relation between the total electric and magnetic loadings and the output per revolution of any three-phase alternating-current machine is—

$$\frac{\text{volt-amperes}}{\text{revs. per min.}} = 1{\cdot}11 \frac{\text{X Y}}{60 \times 10^8}.$$

Replacing the total electric and magnetic loading values by the corresponding intensity of loading values, we get the Thompson equation for alternating-current machines—

$$d^2 l = \frac{1}{1{\cdot}11} \times \frac{60\,8 \times 10^7}{\psi\, q\, \text{B}} \times \frac{\text{volt-amps}}{\text{R.P.M.}}.$$

The only difference between the formulæ for A.C. and D.C. machines is in the constant, which is smaller than for the latter.

In the diagram, fig. 5—

Quadrant 1 gives the relation between the output per revolution and the product of the magnetic and electric loading intensities (B × *q*).

Quadrant 2 gives the relation between the output per revolution and the size of the armature core (the $d^2 l$).

Quadrant 3 gives the relation between the diameter of the armature and the $d^2 l$ value of the armature for various numbers of poles, on the assumption that the poles have square faces.

Quadrant 4 gives the relation between the diameter and length of the machine for any number of poles, and square pole faces.

By comparing the corresponding direct and alternating-current diagrams, figs. 1A and 5, it will be seen from quadrant 2 of these diagrams that for the same output alternators are approximately twice as large as direct-current machines.

The chief difficulty in obtaining small sizes for alternators of the stationary armature type does not lie with the armature; it is a question of storing sufficient field copper on the alternator poles. This is due to the fact that the ratio of field ampere-turns to armature ampere-turns has to be very great to prevent the rise in pressure exceeding the permissible value. If it were possible to get over this question of pressure rise, alternators might be designed to give even a greater output per $d^2 l$ than equivalent direct-current machines.

In quadrant 2, fig. 5, is reproduced the curve given in quadrant 2, fig. 1A, to the same scale, showing at a glance the relative sizes of alternating and direct-current generators for a given output.

If considerations of pressure rise were neglected the ratio of the total electric to the total magnetic loading could be so chosen that the minimum weight and cost of material, and maximum efficiency were assured.

On these lines the authors have estimated the cost of the active material in a standard 250-K.V.A. alternator with a ratio of Y : X = 1,200, and also in the assumed case of a 250-K.V.A. alternator

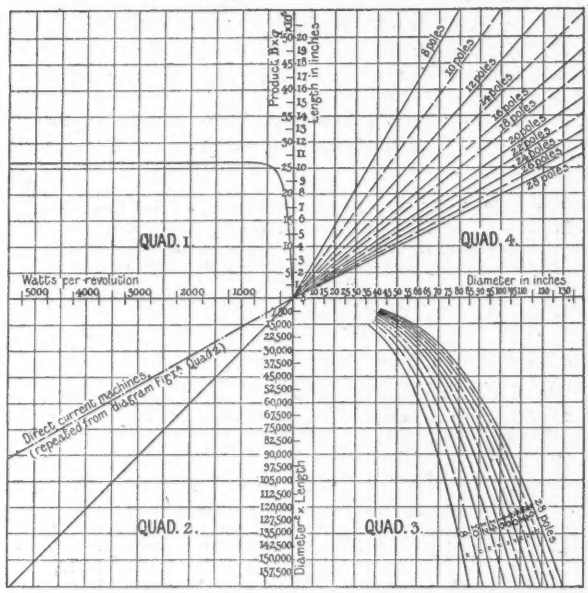


FIG. 5.—RELATIONS BETWEEN OUTPUT FACTORS AND ARMATURE CORE DIMENSIONS FOR SQUARE POLE-FACE ALTERNATORS (AVERAGE MODERN PRACTICE).

with a ratio of 300. The cost of the active material for the standard machine was found to be nearly twice that of the minimum-cost machine.

The question of pressure rise is therefore all-important. Its value can be approximately estimated by considering that the whole electric circuit consists of two parts, that is: an external part, consisting of the feeder and network, and having a resistance = $R_1$ ohms, and a reactance = $X_1$ ohms per phase; and an internal part, consisting of one phase of the alternator winding, having a resistance = $r_1$ ohms, and a reactance = $x_1$ ohms.

The total impedance of the circuit is—

$$E_0/C = \sqrt{(R_1 + r_1)^2 + (X_1 + x_1)^2},$$

where $E_0$ is the total E.M.F. generated in one phase of the alternator winding, and C is the load current delivered to the network.

If $E_1$ is the terminal potential difference per phase, and $\phi$ is the angle of lag of the current behind $E_1$ in the external circuit, then cos $\phi$ is the power factor, and—

$$R_1 = E_1/C \,.\, \cos\phi, \qquad X_1 = E_1/C \,.\, \sin\phi.$$

The value of $r_1$, the armature resistance per phase, can be obtained from the dimensions of the armature conductor, and in order to estimate $E_0$ it only remains to find the value of $x_1$, the armature reactance per phase. This depends on the value of the leakage flux that links each coil, and this can be approximately estimated as follows, namely:—

If K is the permeance of each slot, then $K = a/3\,b + c/h$ (see fig. 6).

If there are $S_1$ slots per pole per phase, then the permeance = $K/S_1$. Also, the leakage flux per ampere-turn per inch = $K/S_1 \times 3{\cdot}19$. If $l''$ is the core length without ducts, then the embedded leakage per ampere-turn = $K/S_1 \times 6{\cdot}37 \times l''$.

For the free length leakage it is sufficient to assume a value of one line per ampere-turn per inch. If $l_1''$ is the free length of one turn, then $l_1$ = free length leakage, C.G.S. lines per turn. If T is the coil pitch of the machine, it is sufficiently near to assume that $l_1 = 3{\cdot}5\,T$. to allow for ventilating ducts, &c.

The total leakage per ampere-turn is therefore—

$$N_s = 6{\cdot}37 \times l/s_1 + 3{\cdot}5 \times T.$$

If $s$ = number of turns in each coil of the stator winding, and $n$ = number of coils in series per phase, then the total reactance per phase is—

$$x_1 = 2\pi f \times s^2 \times n\,(N_s) \times 10^{-8}$$

The actual value of $E_0$ can now be obtained from the equation given above, but this is not nearly so important as the phase angle $\theta$ between $E_0$ and the load current $C$, as on this depends the value of the armature M.M.F., which acts in opposition to the field M.M.F. The value of this angle is $\tan^{-1}\theta = (x_1 + x_1)/R_1 + r$ and the opposition M.M.F. of the armature is equal to $s \times c \times \sin\theta$, and this is equivalent to $s \times c \times \sin\theta \times \nu$ ampere-turns on each field-pole, where $\nu$ is the Hopkinson leakage coefficient.

From the no-load characteristic of the machine the value of the field ampere-turns required to generate the armature E.M.F. per phase ($E_0$) should be found and added to the ampere-turns obtained from the expression $s \times c \times \sin\theta \times \nu$. This value when applied to the no-load characteristic will give the potential difference at the terminals of the machine when the load is thrown off.

No. 2 as a function of the load current per phase on the assumption that there is no pole saturation, that is, that the no-load characteristic does not bend.

No. 3.—The potential difference at the terminals of alternator No. 2 as a function of the load current on the assumption that the pole is highly saturated—that is, that the characteristic is the same as that given in Curve 2, fig. 7.

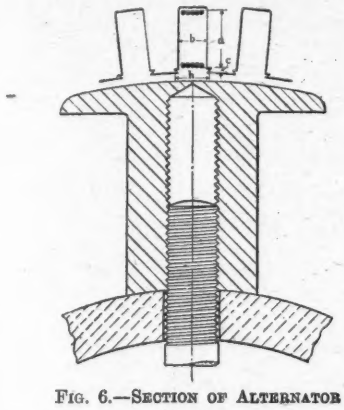


FIG. 6.—SECTION OF ALTERNATOR POLE.

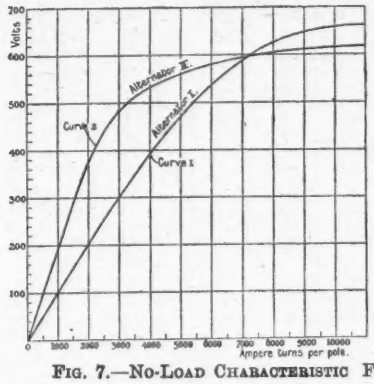


FIG. 7.—NO-LOAD CHARACTERISTIC FOR ALTERNATORS.

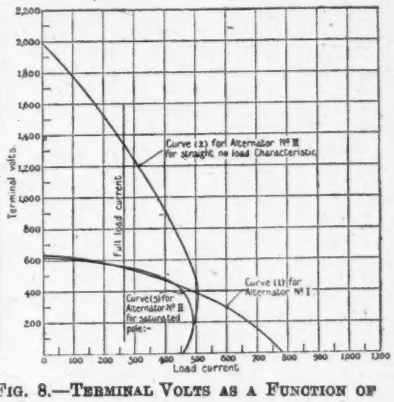
Terminal volts.
Curve (2) for Alternator No II For straight no load Characteristic
Full load current.
Curve (1) for Alternator No I
Curve (3) for Alternator No II for saturated poles
Load current

FIG. 8.—TERMINAL VOLTS AS A FUNCTION OF THE CURRENT ON A 0·8 POWER FACTOR CIRCUIT.

## DISCUSSION.

COL. CROMPTON emphasised the advantages derived both by the authors and by their hearers from "pooling" their ideas at the Institution, and recalled the days when Prof. Kapp and himself discovered that the armature was the controlling factor in dynamo design. The paper, he said, answered the allegation that the British were rule-of-thumb engineers.

MR. HAWKINS appealed for more accurate terminology, and pointed out that for alternators curves could not be laid out with the same validity as for D.C. machines, owing to the influence of the frequency and fly-wheel effect; the field-magnet poles being inside the armature also altered the conditions. He thought the only advantage of the screw adjustment in the pole-pieces was that it provided for variations in the quality of the steel. The best device for cheapening the design by controlling the voltage rise was the Tirrill regulator. Regarding armature reaction, he pointed out that the authors used the angle between the current vector and the impressed E.M.F.; it was better to adhere to Blondel's method of calculation. The angle required was that between the current vector and the centre line of the pole, a larger angle than that used by the authors.

PROF. S. P. THOMPSON commented upon the remarkable progress that had been made since Mr. Goldschmidt's important paper was read in January last. He had himself pointed out the importance of the question of specific loading, and had given the ratio of magnetic to electric loading the order of thousands; Goldschmidt gave 800 for the ratio, and now the authors gave 250 or thereabouts—the difference being due to the adoption of auxiliary poles. The rule that the cost of the copper should equal that of the iron must not be rigidly adhered to. He pointed out the advantages of bringing the coils of stator and rotor out straight, so as to be close together at the end bends, thus bringing mutual induction into play to diminish the self-induction.

MR. MILES WALKER said the quadrant diagrams were of immense value, but the numerous variables involved caused great difficulties in design, and they were liable to be misled by diagrams. They must not conclude that the ratio given for $L:T$ was necessarily correct; minimum values often changed very slowly, and in this case, instead of 0·6, $L/T$ might easily be made 1·0, while the self-induction was only changed by 4 per cent., and other constants could be varied 50 per cent. It was impossible to prove that any particular length or diameter was the best, owing to the cost of manufacture, a factor which could not be put into a formula. The figures agreed very well with practice, but a 50-cycle 500-H.P. induction motor could be made with a much better power factor than 0·87.

MR. G. STONEY said that Messrs. Parsons were now getting three times the specific loading that they used to, and the hysteresis losses had gone down to ¼ in his own recollection. They could even get iron giving 0·2 watt per lb. at 4,000 lines, or ⅓, and the specific resistance had gone up to six times as great, so that the eddy-current losses were ⅓. Ventilation was most important; the problem was to put the maximum amount of iron, copper and ventilation into a given space. His experience was that temperature rise was more important than pressure drop. The mode of regulation described in his paper of April last was being used by Messrs. Parsons with most satisfactory results; and it had no moving parts whatever. The high saturation recommended for alternators was a very dangerous thing; a slight mistake would spoil the design. For the sake of safety and to give a margin of voltage, it was most important not to saturate the iron too much; it also helped in case of an unexpectedly low power factor.

MR. GLENDINNING said that it appeared that all machines

For the Hopkinson coefficient the authors have found that values between 1·3 and 1·4 give very good results.

It is difficult to see where improvements with regard to reducing the size and cost of alternators for a given output can be made, for although many attempts have been made to get a satisfactory compounding device, none of these has been very successful up to the present time, one of the reasons being that most of these devices have been fitted to the exciter, with the result that the alteration to the field excitation lagged behind the change of load; therefore it is probable that compounding devices which are not directly applied to the alternator will never be entirely successful. The authors suggest that the old method of saturating a part of the iron section of the magnetic circuit might be made to give good results by careful design. Thus in fig. 6 is shown the section of a pole which is considerably reduced by the screw hole extended. The iron part of the pole above the tip of the screw becomes highly saturated, and this has the effect of flattening out the no-load characteristic, as seen from fig. 7.

In order to obtain the best results the magnetic resistance of the air-gap should be low. This can only be done by reducing the air-gap density to the lowest possible value, preferably by increasing the pole-face area, using semi-enclosed slots, and reducing the length of the air-gap to a minimum. If the pole is over-saturated, so that the requisite E.M.F. cannot be obtained on full load, the length of the saturated part of the pole can be reduced by screwing the holding-on bolts further into the pole. Comparative designs of two alternators of the same output are given below.

No. 1 is an ordinary commercial alternator, and No. 2 is an alternator designed on the lines just suggested, having a $d^2l$ value of about one-half that of the first alternator.

The no-load characteristic of No. 1 alternator is curve 1, and for No. 2 alternator is curve 2, fig. 7.

Table II gives the core dimensions, the air-gaps, the potential difference as estimated by the above method on non-inductive and inductive loads, and also the ratio of the field ampere-turns per pole to the armature ampere-turns per pole in both cases.

TABLE II.

| | No. 1. alternator. | No. 2. alternator. |
|---|---|---|
| Core dimensions (gross) ... ... | 36 in. × 22 in. | 36 in. × 11 in. |
| Air-gap ... ... ... ... | ⅝ in. | ¼ in. |
| Potential rise, full load to no load, on 0·8 power factor ... ... | 15 per cent. | 13 per cent. |
| Potential rise, full load to no load, on unity power factor ... ... | 4 per cent. | 5 per cent. |
| Ratio of field ampere-turns to armature ampere-turns per pole ... | 3·7 | 2·2 |

Also curves, fig. 8, give for a 0·8 power-factor circuit:—

No. 1.—The potential difference at the terminals of alternator No. 1 as a function of the load current per phase.

No. 2.—The potential difference at the terminals of alternator

which sparked were now over the temperature limit. He had found that machines with shallow slots ran better than those with deep slots. The effect of economising on the commutator might be very bad. The tendency of recent years had been to increase the diameter, but the authors had taken a rather long armature as their standard, and rather small poles. He had used greater windage and larger poles. The chief increase in output was to be looked for from the new steel alloys, which would come down in price and would then be available for both high and low speed machines. Enamelled wire was now made, the enamel on which would stand 1,000 volts per mil even when bent, and would stand soldering heat for a short time. The price was 30 per cent. more than that of cotton, but would come down. Aluminium wire for field windings would probably reduce the cost. Improvement in the ventilation of armatures and field magnets was an important factor.

The authors' reply was deferred.

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## Electricity as Applied to Heating and Cooking.

By S. R. GIBBON.

(*Abstract of paper read before the* LIVERPOOL AND DISTRICT ELECTRICAL ASSOCIATION, *December 8th*, 1908.)

THE essential features of effective and satisfactory cooking and heating apparatus are:—

1. The operation to be carried out as rapidly as its limitations will permit.
2. The highest commercial efficiency possible, *i.e.*, with the water standard.
3. There must be no smell or dirt.

Most operations, except the boiling of water, form their own limitations, as if the operation is carried out too quickly the articles will burn; otherwise the chief is the "coefficient of conduction" whereby the heat capable of being generated is limited by the rate at which it can be carried away and used for useful purposes, otherwise the wire, or metal film, according to construction, will be fused.

Another consideration is the current flow required to obtain high rates of heating, as Corporations and supply companies generally limit the current set in flow by the closing of any one switch; this necessitates the employment of a rheostat or some other suitable arrangement, *e.g.*, switches; in addition to this increased cost, there is further capital outlay in heavier mains, switches, &c.

Speaking generally, there are two principles of heat generation, electrolytic, and hot wire, or film.

The electrolytic is employed in the Fuller geyser, which gives a continuous stream of hot water at the rate of two pints per minute, using 1·5 KW.

The glow lamp is generally employed only for radiators and medical purposes; it is efficient, and lends itself to artistic arrangement, hence is much employed in private houses and hotels.

The hot-wire system, as exploited by the Phœnix Electric Heating Co., is of simple construction, there being no insulation round the wire. Further, every care is taken to allow of expansion and contraction of the wire, which is of special alloy. It is enclosed in a specially constructed case giving rapid and highly efficient conduction.

The General Electric Co. use for such articles as pans, kettles and hot plates, the "Archer" system, in which a bottom layer of a semi-refractory coating is fused into the iron at a very high temperature. On this coating are laid wires of a special composition crimped to counteract self-induction when used on A.C. circuits. They are surrounded by a second coat of special enamel which ensures the wires remaining in their proper position. This is again covered by a third coat of special enamel, and the whole is fused into an integral mass, sealing the conductors inside.

To obtain this combination of enamels has necessitated extensive experiments in order to secure coefficients of expansion of a suitable order. With a system of this character, the conductor is brought very close to the article heated, on an average within ·036 of an inch. As the chief loss is due to imperfect conduction of heat from the source, the Archer enamel system fulfils the requirements well. With this system an efficiency of from 90 to 97 per cent. is obtained.

In the ovens manufactured by the General Electric Co., direct heating is used—*i.e.*, spiral coils of special wire are wound round porcelain insulators, the elements being of comparatively small dimensions, and very simply though effectively supported. They are very readily changed, or replaced in case of failure, by an inexperienced person.

The General Electric Co. have an extremely simple and ingenious contrivance in connection with apparatus which is in danger of burning out, if left on heat without liquids in. It consists of a fusible plug, which melts and cuts off the current when too high a temperature is reached. No small amount of research has been required to obtain an alloy which will melt just above the boiling point of water, and yet below the melting point of solder.

The Prometheus system consists, primarily, of resistances composed of metallic films deposited on insulating bases. For the latter, thin mica strips are employed, and the film is protected from mechanical injury by enclosure in a metal case, from which it is efficiently insulated. Electrical continuity is established by means of flat metal terminals held in close contact with the two ends of the film. A number of different forms of these resistances or "elements" are used, each suited to the particular conditions under which it has to work, and the size and shape of the apparatus on which it is employed.

Unlike all wire systems, all this apparatus is free from self-induction; consequently it absorbs—at any particular voltage—the same power, whether used with continuous or alternating currents, and is independent of the frequency of the latter.

"Open" elements are assembled on light rectangular metal frames, and are held in position by strong flat springs, into which they are slid. All the elements are electrically in parallel, and any or all can be instantaneously inserted or removed from the frame which supports them.

A closed element is used for hot plates, or flat-bottomed utensils such as kettles, urns, &c. The terminals are composed of pure nickel strips, and the turn at the end of the strip is used, in conjunction with a reinforcing cap, for gripping the conductors which are threaded through them. A number of different sizes are employed, the smallest being about $2\frac{3}{4}$ in. × $1\frac{1}{4}$ in. The elements are assembled directly under the under surface of the vessel which it is required to heat. The requisite pressure between every portion of the element and the surface on which it lies is secured by means of a backing plate placed directly over it, a sheet of non-conducting material being inserted between the backing plate and the element, and the former tightened down by screws. In cast vessels, the surfaces on which the elements are assembled are machined, so that absolute uniformity of pressure is exerted by the backing plate over the whole element.

Ring elements are employed for vessels of cylindrical shape, and on tubes (for rapid water heaters). They are attached to the "hot wells" or tubes by being bent round them, and the two ends are drawn together, by screws and nuts, until the requisite pressure over the whole surface of the element case is obtained. This method makes interchangeability a very simple matter.

The elements are connected in parallel, hence, should one or more break down, the efficient working of the others is in no way impaired.

The control of temperature is provided for by a special regulating plug, which is a simplified form of parallel-series controller, combined with an indicating device showing the relative power consumed.

The transformer and eddy-current system is employed in the "Tricity" cooker, which is being introduced by the Berry Construction Co., London. It possesses the great advantage that it can be left on at full power all day without suffering the slightest injury; it may, in fact, be used as an efficient radiator for heating a room, as it can easily be carried about, and can be connected with a wall plug. A full description of it was given in the ELECTRICAL REVIEW, September 25th, 1908, page 493.

Under the heading of specialities, reference may be made to Messrs. Christy Bros. & Co.'s millers' sample ovens, and laundry apparatus, which are especially efficient for these classes of work.

With a small room of 1,500 cb. ft. capacity it should be theoretically possible to raise the temperature of the air in the room from 32° to 60° F. with about 200 watt-hours. If the air in such room is changed twice an hour, a radiator consuming 400 watts will be theoretically necessary to maintain a temperature of 60°, the temperature of the outside air being as low as 32° F. Now, if an electric radiator consumes 1 KW., its efficiency for air warming will usually only be about 40 per cent., but it can be increased to, at least, 70 or 80 per cent. The capacity of an electric radiator for warming air depends principally on the amount of convected heat given out by the apparatus, and this percentage of convected heat is in inverse ratio to the temperature difference between the apparatus and the surroundings. If the electric radiator has a temperature difference above the surroundings of 1,200° F., the percentage of radiant heat emitted by the apparatus will be approximately 95 per cent., so that only 5 per cent. of the heat will be used for direct air-warming or convecting purposes. The radiant heat emitted by the apparatus will impinge upon the walls of the room, thereby warming these walls, and in this case a great part of the heat will be dissipated on the outside of the walls; the percentage of heat thus dissipated depends upon the heat conductivity of the walls, and in the case of very thin walls or windows this may be very great indeed.

At a temperature difference of 600° to 700° F. the percentage of radiant heat given out by the apparatus is still about 70 per cent., and only 30 per cent. is used for direct air warming; at a temperature difference of 100°, however, the percentage of heat used for direct air warming becomes very great, and an electric radiator having an outside temperature of only 100° F. above the surrounding air can by judicious design and construction be made to have an efficiency of 70 to 80 per cent. for direct air-warming purposes.

The efficiency of the apparatus will be greatly assisted if the covering of the wall is of such a nature as to retain a stagnant layer of air close to the walls, which effectively insulates the wall from the heated layers or currents of air moving along the wall, and thereby prevents the heat of the air in the room from being imparted readily to the wall itself.

If the electric radiator produces a great percentage of radiant heat, this stagnant layer of air is no insulator, because the radiant heat will pass through it without incurring appreciable loss.

The Electroyl radiators made by Messrs. Purcell & Hobbs have an efficiency of 70 to 80 per cent. for direct air-warming purposes, and will therefore bring electric heating within the reach of everybody, provided that the cost of electricity does not exceed 1d. per unit.

In many types of electric radiators, the working temperature is so high that the greater part of the heat is given off as radiant heat. With such radiators, the air can only be heated indirectly; that is, by coming in contact with bodies some distance away from the radiators. The intensity of these heat rays decreases with the square of the distance. A few of the advantages claimed for "Electroyl" radiators are briefly as follows:—

Low first cost and exceedingly low running cost, that is, approximately ¼d. per hour for every 10 sq. ft. of heating surface, based on a heating rate of 1d. per unit; hygienic treatment of the air, the temperature of the radiator being approximately 150° to 200° F., which is uniformly dissipated over a large area of heating surface; the whole apparatus is hermetically sealed, and has no moving parts or valves to get out of order; no self-induction; the elements are suspended in liquid, and hermetically sealed; they are not affected by vibration, and great fluctuations of mains pressure are said to have little or no effect on their life.

The author commented on the pushing policy of the Marylebone Borough Council in respect to electric heating and cooking, and hoped that other supply companies and municipalities would follow their example.

## OUR LEGAL QUERY COLUMN.

*[Questions addressed to this column should be written on one side of the paper only.]*

"LEGAL" writes:—"Some time ago you reported, I think, a case of great interest. So far as I can remember, a gas company supplied gas to a town hall for a number of years. Eventually they found that they had read the meter wrong all the time, and accordingly they presented an account for the amount which they had omitted to invoice. I understand that they got judgment for three years back. If you have a note of it, or the number containing the account, I would be glad to have the information."

*** We have been unable to trace the decision alluded to by our correspondent. But we have found the report of a case in our columns which may be of use. The reference is City of London Electric Lighting Co. *v.* Melling, ELECTRICAL REVIEW, November 23rd, 1906, page 820. In that case an action was brought to recover £2 19s. 9d. for electrical energy supplied. The defence was that the meters were inaccurate. It was proved that the company had supplied the defendant with current for some time. It had recently been discovered that the meter was registering current against him when, in fact, he was not using electric light. The defendant objected to pay the last account, as he said he was only using half the radiators formerly alight, and the company had charged him four times more than was usual at that period of the year. The plaintiff company's Act of Parliament provided that where a dispute arose as to the accuracy of a meter it was to be tested by the local electrical official. The city corporation's electrical engineer, Mr. A. A. Voysey, had made a test, and then it was found that the meter was all wrong. The company then made their present claim, but the defendant still refused to pay. After hearing the defendant, Judge Lumley Smith said he was sorry for him, but he was bound by the meter according to the contract to supply. The defendant said: "Supposing they charge me for 1,000 units more than I have consumed, must I pay?" Judge Lumley Smith: "Yes, if the meter says so." Judgment was then given for the plaintiff company with extra costs, the case being one of importance.

## LEGAL.

### WRIGHT *v.* FULHAM ELECTRIC JOINERY CO.

IN the Lord Mayor's Court last week, before Mr. Assistant Judge Jackson, sitting without a jury, this case was heard. The plaintiffs, Mr. F. E. Wright and another, assignees of Mr. Bruno Hirtle, formerly trading as the Electromotor and Dynamo Co., Gray's Inn Road, sued the defendant company for certain repairing work done to electric motors fitted in their workshops. The claim, £19 14s., was made up of eight items, two of which—one of £10 1s. and another of £2 3s. 11d.—were not in dispute. The defendants, however, raised a counterclaim for a sum of £19 14s. for loss and expenses incurred through alleged defective motors fitted up by the Electromotor and Dynamo Co.

MR. LIVERSEDGE, counsel for the plaintiffs, said that Mr. Hirtle had obtained a contract from the defendants to fit up their workshops at Fulham with electric motors, the defendants agreeing to buy upon the hire-purchase system. Mr. Hirtle gave the defendants an undertaking to the following effect: "We guarantee our plant for a period of one year, during which time we undertake to repair or replace free of charge any part or parts which may get out of working order owing to faults in material or defective workmanship." There had been a good deal of correspondence between the parties. The defendants had complained that the electric motors had not been put in within the time stipulated. The work was eventually finished on May 1st. The defendants had from time to time requested that work be done to the motors and other appliances. Some of this work had to be carried out under the terms of the guarantee. The work, however, for which the claim was now made, was not due to any negligent workmanship or fault in the material, but owing to the careless working of the motors by the defendants' workmen.

MR. HIRTLE, formerly proprietor of the Electromotor and Dynamo Co., called for the plaintiffs, said that when he called at the defendants' place after the installation of the motors, he found them in a very neglected state and covered with sawdust. He called the foreman's attention to the state the motors were in, and was told that they had no time to see to them. He told the foreman that the machines could not be expected to work satisfactorily if the motors were kept in such a state. He (witness) said they were willing to send men down and do everything to satisfy them, but they could not be responsible for any trouble caused through sawdust getting into the motors or their bearings. Some of the items charged for were for work done in repairing "starters" which had become burnt out through the electric current being sent too quickly to the motors. This was owing to the improper handling of the starters. Parts of motors had also to be replaced owing to the wear and tear of the machine.

MR. RICHARD JONES, electrical engineer, who attended to the fitting up of the motors at the defendants' place, said that the work was done in a proper manner. They were the ordinary types of motors which they were in the habit of supplying, and he had superintended the fitting of hundreds of similar motors. Many of the repairs required to be done by the defendants were not caused through defective material or the construction of the motors, but through the neglect of the defendants' workmen. He (witness) had complained to the defendants' manager and foreman of the way in which the starters were used. The motors were kept in a worse condition than any he had ever seen. He had pointed out the way in which to counteract the effects of sawdust.

MR. C. KAHN, an electrical engineer, was also called for the plaintiffs. He said he had attended at the Fulham Joinery works from time to time to supervise the fitting up of the electric motors. Standard pattern motors were supplied which gave standard outputs. The work of fitting them up was properly carried out. Cross-examined, the witness said he had decided the horse-power of the various motors required by the defendants, after discussing with Mr. Easton, their manager, the nature of the work proposed to be done.

For the defence, COUNSEL said under the guarantee given by Mr. Hirtle, his submission was that the motors were to remain in working order for a year, and that the only things which were required to be replaced were those due to faulty construction.

The ASSISTANT JUDGE said he could not adopt that view. There was only one guarantee, and that was to make good any faults in the material, or defective workmanship.

COUNSEL also contended that by Sec. 14 of the sale of Goods Act there was an implied guarantee that the goods supplied would be fit for the purpose required. There had been an unreasonable delay in fitting up the motors at the works, the loss upon this head amounting to £100. The present action, however, being brought by trustees, they were unable to counterclaim for more than the sum sued for in respect of this loss.

MR. ALBERT JAMES EASTON, managing director of the defendants, said that shortly before February 15th he had an interview with Mr. Kahn at the works with reference to fitting electric motors to drive their machinery. Some of the motors supplied did not work well. The power, he thought, had been under-estimated, the result being that the motors were pulled up and stopped. Cross-examined, he could not remember how many payments were made before the motors were purchased. The transaction was carried out by bills. He could not state how many bills were given. The motors had been paid for. The defendants' works were burnt out on February 22nd, and the motors were all fully insured. They had received the insurance money.

The ASSISTANT JUDGE said that after hearing the witness called for the defendants, he could not say that the work for which the plaintiffs were charging, was due to defects that came within the terms of the guarantee. After having heard the witness for the defence, he should accept the evidence given by the plaintiffs' witnesses.

The defendants' COUNSEL said under those circumstances he could not profitably occupy the time of the Court longer.

Judgment was entered for the plaintiffs on the claim, for £19 14s., and also on the counterclaim, with costs.

### MANLEY *v.* KRANTZ.

IN the City of London Court, on Thursday, before Judge Lumley Smith, K.C., a claim was made by Mr. J. W. Manley, electrician, Woodville Road, New Barnet, to recover £2 5s. for Osram lamp fittings and holders, supplied to the defendant, Mr. O. Krantz, Angel Court, Throgmorton Street, E.C.—Defendant said he was under no liability to the plaintiff, as he had called a meeting of his creditors and settled all he had. The mortgagees turned him out. Plaintiff said he knew nothing about that. He was no party to the deed of arrangement.—Judge Lumley Smith, K.C., said he must find for the plaintiff with costs.

### ALLEGED ATTEMPTED FRAUD ON W. T. GLOVER & CO., LTD.

A MAN, named Thomas Mitchell, was brought up at Dukinfield, last Thursday, charged with attempting to obtain £20 from Messrs. W. T. Glover & Co., Ltd., electrical engineers, &c., Trafford Park,

by means of false pretences. The accused, it was stated, wrote to Messrs. Glover, on a note heading belonging to the Central Uruguay Railway Co., Monte Video, asking for tenders for cables. He stated that neither the lowest nor any tender would necessarily be accepted, but that all intending contractors must send a deposit of £20, and that the reply letter must be addressed, "D. S. Olliver, General Post Office, Dukinfield," not later than December 14th. Messrs. Glover doubted the *bonâ fides* of the applicant, and communicated with the Superintendent of Police at Dukinfield. When Mitchell called at the Post Office, and asked for a letter which had been addressed as per instructions, he was detained and handed over to the police.

The SUPERINTENDENT, in asking the magistrates for a week's remand, said the prisoner had been attempting to obtain money by similar means from engineering firms in America, Paris, Holland, and other countries.—The prisoner was remanded.

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OPPENHEIM *v.* HARRODS' STORES.

THE hearing of this case has already been reported in the ELECTRICAL REVIEW for November 20th, 1908.

His Honour JUDGE BRAY last week delivered judgment on the claim, which was for £38 10s., the value of a chandelier which it was alleged was broken through the negligence of an employé of Harrods' Ltd., who had been sent to clean the fitting at the residence of plaintiff in Kensington. In giving judgment his Honour said that, in his opinion, the attachment was not mechanically improper. The man who handled the chandelier seemed to have been altogether ignorant as to how these were hung; the only ones he had seen before were hung with hook and chain, and it never occurred to him to look at the attachment of this chandelier. If he had, he said he should not have realised that it had become unscrewed or in any way insecure, and in that case the defendants had sent an inexperienced and unskilled man. It seemed to his Honour that if the nipple was screwed home, or nearly home, the negligence lay in turning the chandelier round without first looking to see what the effect would be if it was insecure almost to parting point, and in cleaning it without first looking to see whether it was in an apparently secure condition. In these circumstances there would be judgment for the plaintiff for £38 10s., the agreed amount, with costs on the higher scale.

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## PARLIAMENTARY.

**Bury Tramways and Electric Department.**—The Bury Corporation is seeking in the next session of Parliament to consolidate the various Acts relating to the borough.

**City of Bath Electric Supply.**—Parliamentary powers are being sought to incorporate a company, with a capital of £100,000, to take over the electricity department of the Corporation and to supply electricity to the city of Bath. Further powers are also sought in regard to supplying outside the district and for entering into agreements with the Somerset and District Electric Power Co. and the Bath Electric Tramways Co. The first directors are to be Messrs. E. Schenk, R. L. Hawkesworth, W. S. Matterson and two others.

**Folkestone, Sandgate and Hythe Tramways Co.**—This company, in the preamble of the Bill which they are promoting in the next session, state that, by reason of the excessive capital cost of the underground conduit system of electric traction, it is financially impossible for them to equip and work tramways on such a system, and they are therefore asking that their Act may be amended so as to allow of the substitution of an overhead or a composite system.

**London United Tramways Co.**—A number of proposals are contained in the Bill which is being promoted by the London United Tramways Co., but the most important is that which has relation to the periods at which the Hammersmith Broadway line and the Uxbridge Road line shall become purchaseable by the London County Council. As the matter stands at present, the County Council can purchase in 1909, or at any subsequent periods of seven years. The company in the preamble to their Bill point out that these lines are most important to their system, and if they are deprived of them, the through traffic arrangements for the carriage of passengers over the Underground Railways, and the tramways will be dislocated, and the public will be prejudiced. Accordingly, it is asked that the dates of purchase may be postponed in the case of the Hammersmith line for 15 years, and in the case of the Uxbridge Road tramway for 10 years. The company further ask that they shall have power to run over certain tramways of the County Council, and that they shall be allowed to work the Richmond tramway by overhead traction.

**Oxford Tramways.**—The Oxford and District Tramways Co. are bringing forward a Bill to rescind, vary and extend, the provisions of the agreement made in 1906, between the Corporation and the National Electric Construction Co. regarding the adoption of the Dolter surface contact system. The preamble states that the system has not realised the expectations of the company, and they seek to substitute a composite system of overhead and conduit traction.

**Bradford Corporation Tramways.**—The Bradford Corporation are asking for power to expend £147,180 on tramways in the Bill which they will bring before Parliament next session. About three miles of new tramways are proposed. By Clause 7 they ask for authority to run 'buses on the trackless trolley system.

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## BUSINESS NOTES.

**Bankruptcy Proceedings.** — THOMAS WARD, late a director of the Electrical Instrument Manufacturers, Ltd., carrying on business at Freezywater, Waltham Cross, living at 22, Totteridge Road, Enfield Wash.—The public examination of the debtor took place at the Edmonton Bankruptcy Court on Monday last week. Mr. Cecil Mercer, represented the Board of Trade, and Mr. Moeran appeared for the debtor, who put his liabilities at £1,161, and stated that he had no assets. In reply to the Official Receiver he said that the petitioning creditor was Mr. d'Hamil, engineer, of North Finchley, who had now proved for £101 12s. 8d., for money advanced by him in respect of certain bills of exchange. The money was used for the purposes of the company, which he started in 1903, and which was now in liquidation The company owed him £1,100, but he did not think there was much chance of getting the money. The Official Receiver: Was there a company? Debtor replied that there was. He had previously been a director of Bishop & Co., Ltd., which was also in liquidation. His salary with the Electrical Instrument Manufacturers, Ltd., was to be £200 a year, but he did not suppose that he had 10s. a week. He sold shares in the company to three persons, and paid the money received into his private account. His son-in-law, Mr. Bugg, had sent in a proof of debt for £679, of which £403 was for the board of a daughter from 1895 to 1898. The Official Receiver remarked that the £403 would be Statute barred. Further examined, debtor stated that for 33 years he was chief clerk at Novello & Co., the music publishers, and was afterwards associated with the Music Publishing Co., which was wound up. In 1899 he started a business at Albany Hall, Enfield Highway, but did not continue it. He had been having money from Mr. Bugg up till the present time; and other people had advanced him sums. He had had no means of his own for the last two or three years, except what he got from the sale of shares or debentures in the company. The £1,100 which the company owed him was in respect of money advanced and salary, &c. The examination was adjourned.

R. S. BLACKBURN, electrical engineer and contractor, Osborne Street, and Ribstone Works, Hebden Bridge.—A second and final dividend of 7½d. in the £ is payable December 29th at the Official Receiver's offices, 13, Winckley Street, Preston.

**Dissolutions and Liquidations.**—MARTEN AND JELLICOE, LTD., Summer Road, Thames Ditton, electrical engineers, &c.—The winding up order in this matter was made on November 6th, and according to the statement of affairs filed the gross liabilities amount to £6,588, of which £5,027 is unsecured, and there are assets estimated at £1,359, the whole of which is absorbed by debentures. It would appear that the company was incorporated on July 24th, 1907, with a nominal capital of £10,500 in 10,000 ordinary shares of £1 each and 10,000 deferred ordinary shares of 1s. each. The company was promoted by Major Jellicoe and Captain Marten, and no prospectus or public invitation for subscription to shares appears to have been issued. It appears that the promoters were directors of another company, the British United Engineering Co., Ltd., whose affairs were in voluntary liquidation, with a receiver in possession. By arrangement with the latter the promoters acquired a considerable portion of its stock, machinery, plant, &c, which, with further stock purchased by Major Jellicoe, they sold to Marten & Jellicoe, Ltd., for £2,200, payment being made to them by the issue of debentures of an equivalent amount. Capt. Lattey joined the board in October, 1907. No fees appear to have been paid to the directors, but a certain amount has been drawn for expenses. At a board meeting on November 11th, 1907, it was resolved that certain patent rights relating to a change speed lever belonging to Major Jellicoe should be purchased for £4,000 cash. At the same meeting the latter applied for and was allowed 4,000 ordinary shares of £1 each. On December 13th following, a cheque for £4,000 in payment of the purchase consideration of the patent rights was drawn and handed to Major Jellicoe, who endorsed and gave it back in payment for the 4,000 shares, at the same time lodging transfers of £2,950 of the said shares in favour of seven persons who had lost moneys in the British United Engineering Co., Ltd., the intention being to cover these persons' holdings in preference shares in that company. On September 13th, 1907, a resolution was passed creating debentures amounting to £10,000 bearing interest at 5 per cent. per annum. Of these £2,200 were issued to Major Jellicoe and his nominees, and Captain Marten £300, the consideration being stock, plant, &c. £2,200 has been issued to subscribers for cash, including £1,000 to Capt. Lattey, who received a commission of £150 therefor, and £200 to Messrs. Nisbet & Co., who claim to hold same to secure payment of £89 odd said to be owing for work done. On October 6th last Mr. A. Nisbet was appointed by the debenture-holders as receiver, and he

took possession of the company's property. The proper books of accounts appear to have been kept, but only indifferently. The cause of the company's failure is said by the directors to be lack of sufficient working capital.

CUTLER, WARDLE & CO., LTD. (in voluntary liquidation).—A meeting of the creditors was held on Monday, December 21st, Mr. L. Wolf (of the Wilson-Wolf Engineering Co., Ltd.) presiding. The liquidator (Mr. A. G. Mellors) presented a statement of affairs. It was unanimously resolved that no application be made to the Court for the appointment of any person as liquidator in place of, or jointly with, the liquidator appointed by the company, or for the appointment of a Committee of Inspection, but that the matter be left in the hands of the present liquidator. It was resolved, however, that the following firms shall act as an informal Committee to confer with the liquidator, viz.:—Wilson-Wolf Engineering Co., Ltd., General Electric Co., Ltd., and Messrs. Baxendale & Co. The statement showed gross liabilities of £2,086, against estimated total assets amounting to £1,450. Deducting loans on debenture bonds (£1,145) and £7 for preferential creditors, there remains £328, making the estimated deficiency of assets to meet liabilities of the company, subject to cost of liquidation, £624. There is a total deficiency as regards contributories (and including the above £624), of £3,130. The following is a list of creditors:—

| | |
|---|---|
| Automatic Standard Screw Co., Halifax | £34 |
| Ashwell, A. T., Nottingham | 100 |
| Baxendale & Co., Manchester | 56 |
| British Xylonite Co., Ltd., London | 17 |
| *Cycling*, London | 41 |
| Central Electric Co., Manchester | 45 |
| Davenport, Sons & Co., Birmingham | 10 |
| General Electric Co., Ltd., Manchester | 101 |
| Johnson, Clapham & Morris, Ltd., Manchester | 68 |
| Lyell, J. C., & Co., Ltd., London | 12 |
| Laborne & Co., Liverpool | 14 |
| *London and Provincial Magazine*, Liverpool | 23 |
| Mellors, Basden & Mellors, Manchester | 86 |
| Morris, W., & Son, Ltd., Birmingham | 58 |
| Doulton & Co., Ltd., London | 12 |
| Wren, H., Manchester | 30 |
| Whittaker & Sons, Ltd., Manchester | 26 |
| Wilson-Wolf Engineering Co., Ltd., Bradford | 76 |
| Creditors under £10 | 153 |
| | £953 |

JOHNSON & MILLER, Queen's Road, Weybridge.—Messrs. T. J. Johnson & A. J. Miller have dissolved partnership. Mr. Johnson attends to debts. The business is thus described in the notice, "Builders and decorators, removal and cartage contractors, ironmongers and house furnishers, upholsterers and cabinet makers, sanitary, heating and ventilating and electrical engineers."

BUCHAN & PARTNERS, consulting, electrical and mechanical engineers, Parliament Chambers, Westminster, and 16, Rutland Square, Edinburgh (Messrs. Home Gordon, M. Buchan & R. W. Hogarth.).—Sir Home Gordon has retired. The other partners will continue the business under the same firm name, and will attend to debts.

BUENOS AYRES ELECTRIC TRAMWAYS CO. (1901), LTD.—This company is winding up voluntarily, with Mr. E. A. Lazarus and Mr. F. Thursby, as liquidators.

ELDON ELECTRIC CO., LTD.—This company is winding up voluntarily, with Mr. W. Sparks, of Newcastle-on-Tyne, as liquidator.

E. G. EVANS, electrical engineers, 46, Stewart Street, and 189, Edward Street, Nuneaton.—Messrs. E. G. Evans and J. F. Grundy have dissolved partnership. Mr. Evans will attend to debts, &c.

**Cable-Making in Spain.**—The *Times* states that the first underground electric cable manufactured in Spain has just been completed at the works of MESSRS. VILLANUEVA & GELTRI, at Barcelona, which were started in May last. The final tests on 12,000 metres of the cable, with a voltage of 50,000, were most successful.

**Book Notices.**—*The Weights and Measures Acts*, 1878-1904. By J. D. Fletcher. London: Sherratt & Hughes. 1908. Price 5s. net.—This work deals only with the sections of the Acts which regulate the use of weights and measures for trade purposes; extracts are quoted from these Acts, with explanatory comments, and particulars are given of the various primary and secondary standards which have been approved from time to time. The latter, of course, include metric weights and measures, and the electrical standards of the Board of Trade. It is interesting to note that such weights as the American short ton of 2,000 lb. are perfectly legal in this country, for this is a definite multiple of the Imperial pound—provided, of course, that both parties know that the unit referred to is being employed. Both metric units and decimal sub-divisions of British units are also lawful. The important point appears to be that the pound, for instance, shall always be an Imperial pound, and that the term shall never be applied to any other unit of weight. As the standard stone weighs 14 lb., it follows that the many other values given to the "stone" by local usage are illegal, and the same applies to the gill when it is used as half-a-pint. The bulk of the work, of course, deals with the minutiæ of buying and selling by weight or measure, especially in retail trade; the duties of the local authorities and inspectors charged with the supervision of weights and measures; and the administration of the numerous Acts bearing upon the subject. A special section is devoted to the sale of coal. Schedules relating to Acts and Orders are appended, and a comprehensive index is provided. The book will be a valuable volume of reference for those who deal by weight or measure.

*Die Elektrotechnik*. By K. Laudien. Hanover: Dr. Max Jänecke. Price M. 3.60 pf.—The somewhat ambitious title of this book is only used to indicate that it deals purely with technical applications of electricity and leaves theory and points of only theoretical interest to existing text-books. It is, in fact, a concise account in simple language of the whole field of electrical applications, and is based on a set of experimental lectures given by the author to artisans and others who come across electricity in one form or another in their daily work and desire a general view of the subject. There is certainly some popular demand for this type of book, but it is doubtful if the information given can be of much use to the reader unless supplemented by additional study, and this is not facilitated in the present case, since all references are omitted. The book is divided up as follows: Pp. 1 to 37 deal with Ohm's law, resistance, Kirchhoff's law, and electrical nomenclature; pp. 37 to 45 with the laws of magnetism; and pp. 45-49 with those of electro-magnetism; pp. 49 to 67 deal with electric measurements, units and measuring instruments; pp. 67-77 with electric heat effects; pp. 77-112 cover the whole subject of arc and incandescent lighting; pp. 112-121, chemical effects; pp. 121-140, electric bells, telegraphy, and telephony; pp. 140-156, electrolysis and accumulators; pp. 156-209, direct-current machinery; pp. 209-258, single and polyphase alternating-current generators, motors, and transformers; pp. 258-270, electric traction; and pp. 270 to 291, switches, fuses, and installation material. The illustrations are especially numerous and clear, and give the book its chief value.

*La Technique Moderne* is the title of a new Paris monthly illustrated review, of which part I (December) is now before us, having just been received from the publishers, MM. H. Dunod and E. Pinat, 49, Quai des Grands-Augustins, Paris. The first number is full of interesting and varied matter, and is, we think, above the average for foreign publications of the kind. Wireless telegraphy; aeroplanes, alcohol in industry, are a few of the subjects handled in article form in the first issue. We wish our contemporary a successful career.

*The "Practical Engineer" Pocket Book and Diary*, 1909. London: The Technical Publishing Co., Ltd. Price 1s. net.—Since we first made the acquaintance of this pocket book—it is in its 21st year, and we have known it for almost as long—it has greatly increased in volume and usefulness. A variety of practical engineering information has again been added to its contents. The electrical matter is now concentrated in the new sister volume, and it is doubtless for this reason that the reference in the index to "Electrical Units" on p. 30 leads to an ineffective search—there are no electrical units to be found. On p. 33 "rustrum" appears for frustum. The book now contains over 600 pages of text, and will no doubt be more than ever appreciated by its users.

*The Practical Electrician's Pocket Book and Diary*, 1909. Edited by H. T. Crewe, M.I.Mech.E. London: S. Rentell & Co. Price 1s. net.—Christmas brings, amongst other old friends, the little red book, now in its 12th year. This caters particularly for the wireman, jointer, dynamo and arc lamp attendant, and electrical workers of all grades, in contradistinction to the more advanced exponents of the art, who are already well provided with such aids. The present edition has been carefully revised by experts, and numerous additions have been made to its contents.

*Hazell's Annual*, 1909. London: Hazell, Watson & Viney, Ltd., 52, Long Acre.—This annual has been revised to November 30th, 1908, and gives as it purports to do, full information on the topics of the day arranged in alphabetical form and accompanied by a copious index. A cyclopædic record of men and affairs for use in 1909 is the sub-title, and there is no doubt that it will be a very serviceable companion to those who have occasion to glance back over the doings of 1908 in Parliament, in art, engineering, law, science, industry, sport, and so forth.

"The Electrical Equipment of Collieries." By W. G. Duncan and D. Penman. London: Scott, Greenwood & Son. 1908. Price 10s. 6d. net.

"The Life Story of Sir Charles Tilston Bright." By C. Bright, F.R.S.E. Revised edition. London: A. Constable & Co., Ltd. 1908. Price 12s. 6d. net.

"Motorist's Diary, Year Book and Legal Guide, 1909." London: Chas. Knight & Co., Ltd. Price 2s. net.

**Time Recorders.**—The INTERNATIONAL TIME RECORDING CO. has just received a repeat order from Fried. Krupp, Essen, Germany, for 50 international card time recorders, making 160 in all.

**Amendment of Patent.**—Application for leave to amend patent No. 24,950 of 1906, "gravity fed arc lamp," granted to F. Blanckensee, G. McMullan and F. Mosey, of Perth, W.A., is announced in our advertisement pages to-day.

**Trade Announcements.**—MESSRS. PRITCHETTS AND GOLD, LTD., announce that owing to increase of business they are removing their sales department to larger premises at No. 58, Victoria Street, S.W.; and all orders and correspondence for that department should be sent there in future. The telegraphic address and telephone numbers remain unaltered.

THE ADAMS MANUFACTURING CO., LTD., of Bedford, are holding a special exhibition of "Igranic" electric motor controlling apparatus at the premises of their agent, Mr. F. T. Hanks, 1, Higham Place, New Bridge Street, Newcastle-on-Tyne, from January 11th to 30th.

**Italy.**—The *Handelsmuseum* (Vienna) of December 10th calls attention to the good openings presented in Naples and South Italy generally for ironmongery, &c. There is also stated to be a constant demand for electrical appliances and insulating material, much of which is apparently intended for Italian warships.

**1908.**—We make the following extracts from Messrs. Bolling & Lowe's trade review of the past year:—

*Rails.*—At the close of last year the syndicate price in England for heavy rails ruled about £6 to £6 5s., whereas to-day for orders of any magnitude and approved specification, as low as about £5 5s. has been accepted, and we anticipate before long prices will be lower. The prices quoted by the English Rail Syndicate depend upon so many factors that it is difficult to know what they are prepared to accept. Sometimes, in cases where least expected, we find the English figures were much higher than those of their Continental neighbours, and *vice versâ*. Prices evidently depend upon the question of allotment among the members of the International Syndicate. In some instances where, in the natural course of events, one would have expected that orders could only be allotted to English makers, it has been noted that Continental and American works have put in their claims, and even obtained them. A new source of competition has arisen in the Canadian steel mills, who have taken orders for India and Australia, and we find the American mills booking business for our own Colonies. In fact, the whole position of the rail trade is inexplicable.

*Iron and Steel.*—The decline in prices of finished products that had set in in the autumn of 1907 continued throughout this year, and the result is that up to the present there has been a decline of about 20s to 30s. per ton in many markets. Marked bars at 20s. per ton less is practically the key to a similar reduction in other iron and steel productions.

*Copper.*—The extreme movement of prices in standard copper has been limited to about £9 per ton, or approximately from about £56 to £65 for cash delivery. 1908 was ushered in with hopeful expectations, chiefly because of the drastic nature of the steps taken in North America to cut down production. Had it not been for the energetic policy pursued in this respect, the price of copper would inevitably have stood much lower to-day. The chief feature of the year has been the enormous speculative business indulged in. During the entire course of the 12 months trading in warrants has been exceedingly free, and a very large proportion of the buying was based upon anticipations of an important recovery occurring in American consumption. Not a few seemed to anticipate that it might even again reach high-water mark, but all hopes of this nature proved to be very far indeed from realisation. Speaking broadly, the first part of the year saw moderate optimism predominant, but since the summer months a complete change has developed regarding supplies in North America. Mines have been re-opened there in all directions, and smelting operations have been pushed forward with the utmost vigour, so that instead of 1908 showing a considerable deficit in output compared with 1907, it is practically certain that a considerable excess will be recorded. To some extent the preponderance of supply over demand is reflected in European stocks, but there are also believed to be considerable quantities of metal awaiting distribution in the hands of American producers and others. The small boom which occurred in October and November was altogether unjustified by any circumstance of trade, and indeed had no more substantial foundation than over-bright hopes of a revolution in American trade conditions being brought about by the result of the Presidential election. The future depends entirely upon the management of the large and still accumulating stocks.

*Germany.*—Nothing can be more significant of the world-wide depression of trade than is shown by the falling-off in a country whose powers of competition, aided by the highest forms of technical ability, are unable to withstand the tide of adversity. The best developed form of organisation notwithstanding, the cry of the unemployed appears to be as loud as elsewhere, and is in itself an index of the absence of business.

**Catalogues and Calendars, &c.**—Messrs. George McCartney & Co, engineers, Burnside Works, Cumnock, N.B., have sent us a small desk paper-weight in the form of a model of their "Orb" ironclad main switch.

Messrs. McClure & Whitfield, "Mersey" Dynamo Works, Adswood, Stockport.—A useful Letts's self-opening pocket diary for 1909, with £1,000 accident insurance coupon, has been received from this firm. The opening pages contain particulars of the "Mersey" multipolar-type generator with tabulated capacities, prices, &c.

Messrs. Venner & Co., 6, Old Queen Street, Westminster, are sending out to some of their friends a most acceptable artistic desk calendar, with an art-metal framework, with a circular picture of "The Hunt" let in, and a small neat frame to the right containing monthly date slips. We are asked to state that owing to the die breaking, the firm are not able to complete the issue of these calendars yet, but that all their customers will be supplied by the middle of January. If any of our readers, who are not among the firm's customers, desire one of the calendars, they are requested to forward 1s. with the request. The calendar does not bear the firm's name, the hope being that friends will utilise it at home, always remembering that it came from Venner's.

Messrs. W. Geipel & Co., of Vulcan Works, St. Thomas' Street, S.E., have favoured us with one of their pocket diaries for 1909, with insurance policy. A number of engineering tables selected by Mr. Geipel have been embodied in the book.

The Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, is once more sending its friends one of its useful desk blotting pads with top envelope.

To the Electrical Power Storage Co., Ltd., of 4, Great Winchester Street, E.C., we are indebted for a blotting pad and diary for the new year. The possession of this pad insures the owner against railway accidents for £500 if the coupon is signed. As before, the month's days are arranged in a narrow card slip along the top edge of the pad.

Messrs. Wm. Harvie & Co, Ltd., 24, M'Alpine Street, Glasgow, have sent us a calendar for 1909, with monthly slips and a letter pocket whereon appears a view entitled "Merrily o'er the Sunlit Sea"—chosen, no doubt, because the firm are specialists in ship-lighting installations.

Messrs. Hayward Tyler & Co., Ltd., 99, Queen Victoria Street, E.C.—The firm has sent us one of its pocket diaries for 1909. Tabulated data and formulæ of interest in connection with water supply, also pictures of electrically-driven and other pumps, hydraulic rams, &c., are included.

North-Western Electrical Appliance Co., Railway Appliances Works, Cathcart, Glasgow.—New catalogue of arc lamp lowering gear specialities, winches and accessories, including their contact suspension appliances, arc lamp suspenders, span wire central and side lowering gear, counter-weight appliances, centre-pole swing out arc lamp carriers, pulley couplings and so forth. The list is very clearly and fully illustrated.

Messrs. Veritys, Ltd., have received so many inquiries from people who wish to purchase their 1,200 pp. catalogue as a book of reference, that they have asked us to state that this can be obtained from any of their chief branches at 2s. 6d. per vol. for each of the three volumes. Postage and packing: 6d., 9d. and 1s. for one, two or three vols. respectively.

The Electric and General Stores Co., of Bridge Street, Sunderland, have sent us a large hanging card, whereon appears a pleasing example of colour-printing work representing "Little Bo-Peep," by G. Sheridan Knowles. A small monthly-slip calendar appears at foot.

The Abbey Electric Co., 17, Victoria Street, S.W.—Circular giving illustrations of the interior and exterior of the "Abbey" flame arc lamp, and prices of same.

Mr. A. H. Hunt, 115-117, Cannon Street, E.C.—New catalogue (No. 22) dealing with the H H. complete system of dry battery ignition with Hellesen dry cells, for motor vehicles and stationary engines of all descriptions. A good deal of additional matter is included which did not appear in either of the two former editions of the catalogue, this including a note of the approximate mileage of each battery shown when used under varying conditions. The various sizes of batteries are illustrated, with a description at each side showing the type of engine for which they are suitable, and the approximate mileage that can be secured. Various types of testing instruments, coils, the "H.H." safety fuse, and a number of accessories, are particularised.

Messrs. Smith Bros., Ayton Buildings, King Street West, Manchester.—A number of circulars have been issued, relating respectively to Mars flame arc lamps, cables and wires (net prices), and Conradty's Noris-Excello carbons.

The Sterling Telephone and Electric Co., 200, Upper Thames Street, E.C.—Pamphlet No. 132 (48 pages), giving fully illustrated particulars and prices of a large variety of "Sterling" telephones.

The General Electric Co., Ltd., 71, Queen Victoria Street, E.C.—The G.E.C. begin the new year with a new catalogue of electric fittings and glassware, consisting of getting on for 300 pages of illustrations printed on enamelled paper, and showing a very varied collection of their manufactures in this department. From our various visits to the G.E.C. showrooms in Queen Victoria Street from time to time, we should gather that in the several departments the different types will be found conveniently classified and suitably displayed. Small accessories, such as ceiling plates, galleries, shade carriers and fixers, ball fittings, switchplates and wire guards, lead off, and all varieties of shades and globes in silk, glass, &c, close the contents. In between there are shown shop and cornice reflector fittings and "Striplite," advertising signs, ship, factory and mill fittings, pendants, brackets, electroliers, standards, newel standards, French bronzes, &c., in all kinds of finishes and of many designs. The catalogue will, no doubt, be very useful to contractors and architects for some time to come.

Messrs. Haslam & Schontheil, engineers and merchants, Western Mail Chambers, Cardiff, have favoured us with one of their handy vest-pocket diary cases, with 12 monthly refills, in which one has a page per day for memoranda. An accident insurance coupon is included.

**Russia.**—According to a *Financial News* correspondent in St. Petersburg, there is a great future for electrical enterprise in Russia at the present moment. "The satisfactory results obtained by the electrical undertakings in St. Petersburg, Moscow, and other towns have stimulated a number of municipalities to substitute electrical for horse tramways. Odessa, Kharkov, Vilna, Baku, and Astrakan, especially, are pushing forward in the matter.

## LIGHTING and POWER NOTES.

**Barking.**—The Electricity Committee has resolved in favour of the following scale of charges being in operation after January 1st:—Up to 100 units per month, 2½d. per unit; 101-1,000 units, 2d.; 1,001-3,000 units, 1¾d.; 3,001-4,000, 1¾d.; 4,001-5,000, 1⅝d.; 5,001-6,000, 1½d.; 6,001-7,000, 1⅜d.; 7,001-8,000, 1¼d.; 8,001-10,000, 1⅛d.; over 10,000, 1d. The electrical engineer has been instructed to report on the question of the laying of an underground cable to the hospital. Considerable trouble has occurred of late owing to constant faults on the overhead service cable. The

electrical engineer has been further instructed to report upon any possible improvement in the working of the tramways bearing upon the financial position.

**Barnsley.**—The T.C. has instructed the electrical engineer to prepare a scheme for lighting May Day Green Markets by electricity.

**Canada.**—In 1906 the city of Winnipeg began to inspect the various water-powers available for hydraulic-electric power. Engineers were engaged by the city to get out a report, and upon the advice of these gentlemen the city determined to proceed with the development of falls on the Winnipeg River, distant 75 miles from the city. Complete designs for the power plant, transmission lines and terminal station were prepared under the supervision of Mr. Cecil B. Smith, and throughout the past two seasons the construction of 25 miles of tramway has been proceeded with, and is now completed. The power construction department of the city is now engaged in the excavation of earth upon the site of the works, and tenders are being called for the construction of concrete and other dams, and for the power house building, all at Point Du Bois, Manitoba. Tenders are also being received for the supply of steel towers and transmission cable, and for the erection of the transmission line between Point Du Bois and Winnipeg. The ultimate capacity of the works will be 60,000 H.P., but the first installation to be made will have a capacity of 20,000 H.P. The construction will be carried on under Messrs. Smith, Kerry & Chase, Toronto, as engineers. The work when completed is expected to give a great impetus to manufacturing industries in Winnipeg.

**Chichester.**—Excellent progress is being made in connection with the laying of the electrical mains, and the power house is rapidly approaching completion. It is anticipated that the supply will be started about the end of January.

**Cornsay.**—The E.L. has been installed in this village for public lighting at a cost of £200.

**Continental Notes.**—GERMANY.—GRODEN (near CUXHAVEN).—A large generating station is to be built here, for the supply of light and power not only to Ritzebuttel, in the Hamburg magisterial district, but to the whole of the Hadeln district and part of the neighbouring district of Neuhaus, within a radius of 50 km. Local committees, under the guidance of electrical engineer Pein, of Hamburg, are being chosen, and it has been decided, moreover, to cover the district with a network of electric railways. A site for the station has been bought on the embankment of the Elbe, and an attempt will be made to make use of the ebb and flow of the river to generate electrical energy.

MEINE (GIFHORN DISTRICT).—Some 40 localities lying around this city are to be supplied with light and power by the Braunschweig-Schöninger Railway, which has concluded contracts with most of the local authorities concerned.

SWITZERLAND.—The Swiss Government recently submitted to the referendum a resolution dealing with the utilisation of the national sources of water-power, which was adopted by a large majority. The Federal Government was invested with powers to safeguard public interests generally, while the cantons were authorised to control the utilisation of the water courses for motive power. When several cantons are concerned and agreement is not attained, the Confederation assumes the control and settles the terms of the concession; and the export of energy can only be done with the consent of the Confederation.

PORTUGAL.—In the report on the lighting of Lisbon presented to the Municipal Council by the Lighting Committee, it is stated that there are 293 electric lamps in use, costing 447,997 fr., or an annual average of 1,529 fr. per lamp. The lighting of the Campo Grande will require 35 lamps. The Committee has obtained the price of 1,430 fr. per lamp per year, or a total of 473,715 fr. for the aggregate of 328 electric lamps which will eventually be in use.

**Dover.**—The T.C. has completed an agreement with the Admiralty for supplying electricity for charging the batteries of submarines.

A loan of £630 for the purchase of a booster has been applied for.

**Farnham.**—It would appear that Farnham will have to do without electric light for some time yet, if the proceedings at the Board of Trade inquiry held on Monday last week, are anything to go by. Mr. G. F. Roumieu, J.P., the chairman of the Electric Supply Co., stated at the outset that underground cables in a place like Farnham were quite out of the question if the undertaking was to be a commercial success; the Rt. Hon. T. H. W. Pelham, C.B., assistant secretary to the B. of T., who conducted the inquiry, said that the general principle of his Board was not to give sanction for overhead wires except in unpopulous places, or in populous places where there was a good deal of waste land and moorland, as was the case very often in large manufacturing districts. They all knew that the overhead system was a great nuisance and annoyance in towns where there was a great deal of traffic. The onus lay on the company, because the feeling of the Board was rather against overhead wires for electric lighting purposes in an urban district or in a populous place. If overhead wires were sanctioned the practice was only to give consent for five years. In stating the case for the company, Mr. Roumieu said that the result of their investigations led them to the fact that the laying of underground cables in Farnham was an impossibility. His company made overtures to the Council, and on February 18th last the Council passed a resolution to the effect that under certain conditions, it would permit his company to install overhead wires. Later on the Council modified the conditions as to the submitting of a plan showing where the standards would be placed, and then a petition against the installation was received by this authority. For the Council, Mr. Wright said it had not shown any spirit of hostility to the introduction of electric light by Mr. Roumieu's company, but felt that it could not give the company *carte blanché* to erect standards where they liked, and it must protect the general interests of the ratepayers. The Commissioner asked Mr. Roumieu if he would consider what he had said with regard to the Board's practice of giving consent for the wires to remain overhead for five years, but Mr. Roumieu could give no undertaking to install electric light under these conditions. The Commissioner said that what the company asked was that the Board should revoke the present order of things and the rule it had been carrying out throughout the country. It would have to make further inquiries into the advisability of doing so. Mr. Roumieu thought if the Board would consider the question further, it would, no doubt, be the means of inducing the installation of electric light in many places which did not have it now. In closing the inquiry, Mr. Pelham said there was a certain difficulty owing to the fact that Mr. Roumieu would not accept the terms of five years, but that would not debar the Board from fully considering the application.

**Glasgow.**—The T.C. has accepted the offer of the electrical engineer to the Corporation for the lighting of the Cameron Memorial clock at Charing Cross, as follows:—(1) £4 6s. 6d. for fitting four 50-C.P. metallic-filament lamps; (2) £4 4s. for lighting the lamps for 4,000 hours per annum; and (3) £2, for fitting up a switch to switch the lamps off and on at predetermined times.

**Haslemere.**—The Hambledon R.D.C. has resolved not to object to the application of the Hindhead and District E.L. Co. for power to extend its area of supply to Haslemere. With regard to Thursley and Witley it was considered not desirable to give powers to the company unless the promoters undertook to lay mains there within two years. The Council has also asked that the maximum price of energy should be 6d. per unit instead of 8d.

**Heston and Isleworth.**—Mr. Sutherland Wilkinson, the district auditor, in his report on the accounts of the U.D.C. for the last financial year, points out that the loss on the 12 months' working amounts to £51 odd. He is strongly of opinion that the deficit should be written off in the district fund. It appeared to be inequitable that the undertaking should be burdened with an accumulated deficit of £918. Had the deficiency been made good before from the district fund, a saving would have been effected in the amount of interest on the overdraft.

**Hull.**—The Asylum Committee of the T.C. is considering the advisability of having the E.L. installed at the asylum.

**Littleboro'.**—The D.C. has agreed to proposals of the Rochdale Corporation for electrically lighting a portion of the district. It has agreed that the Council shall accept the Corporation's offer to supply electricity in bulk at works cost, which, for the past year, is taken at 1·217d. per unit + 10 per cent. Councillor Brook said the present scheme would cost about £2,500, and the repayment of the money for the necessary works will be spread over a period of 20 years.

**London.**—STEPNEY.—The B.C. held a special meeting on December 23rd, to consider a report of the Electricity Supply Committee on the question of legal proceedings against the City of London Electric Lighting Co. The Committee reported that its attention had been called to the fact that the company was furnishing a supply of electrical energy for consumption at the Tower of London, which is within the Borough of Stepney, and outside the company's statutory area of supply. As the town clerk's opinion was supported by counsel's opinion that the company was furnishing the supply without the authority of Parliament, or a licence granted by the B. of T., the Council agreed to commence legal proceedings against the company with the object of restraining it from continuing the supply of electricity to the Tower of London. The Committee reported on Wednesday that the solicitors to the company had now written, stating that in view of the fact that H.M. Office of Works has decided in future to obtain electricity from the Stepney B.C., the company do not consider it worth while defending the action, and accordingly offered to submit to an injunction restraining it from supplying energy beyond the area of supply defined in its Special Orders, otherwise than under the authority of Parliament; and to pay the taxed costs of the action. Accordingly, on the recommendation of the Committee, the Council agreed to discontinue the action against the company.

FULHAM.—In connection with a pamphlet advertising the electricity undertaking, in view of the provisions of the Patents and Designs Act, 1907, the B.C. has given an order for the printing of 3,000 copies (1,000 each in English, German and French), included tinted maps, to Wightman & Co., at a cost of £32 5s.

**Oldham.**—The T.C. is seeking powers to supply energy outside the borough.

**Paignton.**—Electric lighting for both public and private purposes was inaugurated last week. The electrical plant consists of a "National" suction gas plant of approximately 100 H.P., and a "Crompton" belt-driven dynamo, balancer and booster sets, switchboard, and storage battery. The public lighting comprises 14 flame arc lamps of the "Crompton-Blondell" pattern, which illuminate the Esplanade, Torbay Road, Victoria Street, and Palace Avenue. The contract wrs placed with Messrs. Crompton & Co., on August 26th last, and they have completed it

well within the time stipulated, no hitch having occurred during the erection of the works. The only part of the work that the company has still to execute is the refuse destructor. Some difficulty has been experienced in finding a suitable site, but this, it is hoped, has now been got over, and the work will soon be commenced. The public light gives every satisfaction, the sea front being finely illuminated.

**Watford.**—Seven local firms of electrical contractors have written to the U.D.C. with reference to the application by the Council for additional powers to enable it to undertake free wiring of houses for electric light, power and heating, and the supply and fixing of electrical fittings. The writers pointed out that if the powers were granted and used, it would be prejudicial not only to the interest of the writers but also to the ratepayers generally. The town was at present thoroughly canvassed and competitive estimates for installations given without expense to the ratepayers, but if the powers named were granted and the Council opened a showroom, there must be a considerable additional expense to the present heavy burden of the E.L. department. They asked the Council to abstain from seeking the powers, which would inevitably dishearten individual traders, who had spent much time and capital in furthering the development of the E.L. undertaking, and who would, if encouraged to do so, not relax their efforts in the future. The Council has referred the letter to the Committee, to invite the writers to attend and explain more in detail their objections.

## TRAMWAY and RAILWAY NOTES.

**Altrincham.**—The U.D.C.'s intention to grant a lease of the tramways to the Manchester Corporation is notified in the *London Gazette* for December 22nd.

**Australia.**—VICTORIA.—Mr. C. H. Merz's report on the electrification of the Victorian railways has not met with the approval of the Railway Commissioners to whom it was referred. The Commissioners say that the advantages to be derived from the application of electric traction to the Melbourne suburban lines at present from the point of view of the safety, convenience and comfort of the public, and from the railway point of view and also in respect to tramway competition, have all been most carefully considered and weighed by them. They cannot see their way clear to conclude that the advantages are of sufficient importance or value to justify the incurring of the large estimated capital expenditure and annual financial loss which would be involved in the year 1912 by electrification.

The Commissioners agree with Mr. Merz that if the conversion were undertaken forthwith, the direct-current conductor rail system should be adopted, and also the multiple unit system of train operation. The use of more powerful engines on the suburban lines, they think, will enable them to deal with greater traffic without, as previously anticipated, extra expenditure in the near future in the duplication of the lines and the strengthening of bridges, and but little shortening of the block sections. Electrification would result in considerably greater financial loss in the year 1912 than indicated by Mr Merz. If given the time, the Commissioners would have preferred to submit their alterations in estimates to Mr. Merz, in which case the alterations might have been modified in some respects. To undertake the electrification of the lines included in Stage 1 meant a committal to proceed continuously with the other stages until the whole of the suburban lines were electrified.

The Commissioners, therefore, recommend that the electrification of suburban lines be not either in whole or in part undertaken at present. It would not be prudent to incur an enormous expenditure on a system which might not be the best after a lapse of some time. The saving in the transit time proposed, while desirable, would not be more than approximately two minutes for such journeys as from Flinders Street to Hawthorn, four minutes to Caulfield, Camberwell and Elsternwick, and six minutes to Brighton and Williamstown.

The Commissioners estimate the total capital expenditure required for electrification at £2,209,918, as against Mr. Merz's estimate of £2,227,050, but put down the capital expenditure for the continuance of steam working at £405,355, as against Mr. Merz's £425,590. The capital and expenditure required for electrification in excess of that required for steam working is estimated by the Commissioners at practically the same amount as that given by Mr. Merz in the case of the Port Melbourne and St. Kilda lines, but for Stage 1 of the general scheme the Commissioners give it at £687,628, as against Mr. Merz's £651,935; and for Stage 2 at £1,152,601, as against £1,087,992; for Stage 3 both estimates give £1,801,460. The annual working expenses with electric traction in the case of the St. Kilda and Port Melbourne lines are given by the Commissioners at £22,951, as against Mr. Merz's £18,569; for Stage 1 at £83,567, as against £73,571; for Stage 2 at £160,079, as against £140,363; and for Stage 3 at £251,625, as against £219,700.

The Commissioners estimate that in 1912 electric traction, as compared with steam traction, would, after allowing 5 per cent. increase of revenue for electric traction, show a loss of £9,970 on the St. Kilda and Port Melbourne lines, £14,122 on Stage 1, £25,566 on Stage 2, and £48,084 on Stage 3.

The following recommendations are made by the Commissioners:—That the financial results of the electrification of the Melbourne suburban lines, and the advantages which would be obtained, as compared with steam working, be reviewed at reasonable intervals; special consideration being given to the aspect of a likelihood of increased tramway competition.

That the possible ultimate electrification of those lines be always borne in mind on the rearrangement or provision of additional tracks, stations, engine sheds, turn-tables and other locomotive facilities, and, in fact, with all alterations and additions, including rolling stock which might be affected by electrification.

That additional "D D E" locomotives be constructed, as may be required, from time to time, to meet the increasing requirements of suburban traffic, such locomotives, in the event of electrification, being easily and cheaply converted to "D D" engines for general service on country lines, where there will be for some time ample scope for the useful absorption of locomotives of this class.

That the work of lengthening and strengthening such of the existing bogie coaches as are suitable for the suburban traffic be proceeded with as fast as the finances will permit; such lengthened and strengthened coaches being suitable for electric traction.

That the existing platforms be lengthened and existing block sections be shortened, as may be found necessary from time to time, to provide for the safe and efficient movement of traffic (an automatic or semi-automatic system to be adopted in shortening the block sections, provided such a system be found safe, efficient and economical).

The view taken by the Commissioners with regard to the busy hours in the morning and evening, is that an electric scheme would be very little improvement on the steam service estimated as required in 1912.

In brief, the Commissioners say that they recognise that electrification is inevitable sooner or later, but that they do not think the present time is opportune, and they question Mr. Merz's estimates of expenditure and revenue.

**Brighton.**—The Tramways Committee has again taken up the question of charges for energy for the tramways made by the Electricity Committee, and the latter has refused to consider the matter until a balance-sheet has been produced.

**Canada.**—It has been decided to make application to the Provincial Government for a charter for an electrical line to run from Ottawa to Morrisburg, Brockville and Darling, there to meet the North Lanark steam railway now in the course of construction from Ottawa to Darling. Eastward from Morrisburg it is proposed that the line should run to the south-eastern corner of the boundary between Ontario and Quebec. The proposed line, omitting the branch from Morrisburg East, will cover 143 miles. The cost is estimated at $14,000 per mile, and $2,002,000 for the line.

**Continental Notes.**—AUSTRIA.—Three projects are being put forward for the utilisation of the water-power of Lake Achen (Tyrol). According to the first project, that of Major von Donat, as also the second project which is favoured by the Austrian State Railway management, the river which drains the lake, called the Seeache, is to be held up by a weir near Tratzberg Castle, whereby a fall of 400 metres will be created, yielding a water-power equal to 15,000 H.P. The third project, of much smaller dimensions, turns on the use of a waterfall on the Seeache River in the Achenwald, for the provision of light and power to the Commune of Achental. Only one of the three projects can possibly be carried out, and that of the State Railway will—says *Der Elektrotechniker*—probably be adopted.

SWITZERLAND.—A concession has been granted to the company controlling the electric railway which runs from St. Gall to Trogen, for the construction and working of an electric railway:—(1) From Trogen to Heiden, with a branch from Kaien to Rehetobel; and (2) from Heiden to Walzenhausen. The cost of the two sections is estimated at 2,900,000 fr. (£116,000). A 24 years' concession has also been granted for the construction and working of a section of metre gauge electric railways which will run from (1) Zoug to Nidfurren and Oberägeri; (2) Zoug to Baar and Talacker; and (3) Nidfurren to Edlibach and Menzingen. The total length of line will be 22·9 kilometres, and the estimated cost of the work, 1,730,000 fr.—*Board of Trade Journal.*

GERMANY.—A company has just been formed in Breslau with the title Die Breslauer Electromobil-Transport-Unternehmen Gesellschaft (Betu), to establish a parcel delivery system in that town by means of electrical vehicles.

**Devonport.**—The Tramways Committee of the T.C. has received a letter from the secretary of the Devonport and District Tramways Co., stating that it was the intention of the company to discontinue running cars on the leased lines on and after January 16th, the reason assigned being that these lines are unremunerative. The matter was referred to the town clerk. The leased lines were constructed by the Corporation and leased to the company, who own the lines originally laid.

**Dublin.**—An application has been made to the Privy Council for the issue of an order recommended in February, 1906, for an electric railway from Lucan to Leixlip, the line being an extension of the Dublin and Lucan line.

**Kirkcaldy.**—The burgh electrical engineer has recommended an extension of the tramways to Dysart, a neighbouring town. He points out in his report to the T.C. that the cost would be comparatively small, as it was only a question of permanent way, the cars being already at the disposal of the town. An alternative scheme is to extend the system within the burgh, but this would involve more capital expenditure. The whole question is to be discussed by the T.C.

(*Continued on page* 23.)

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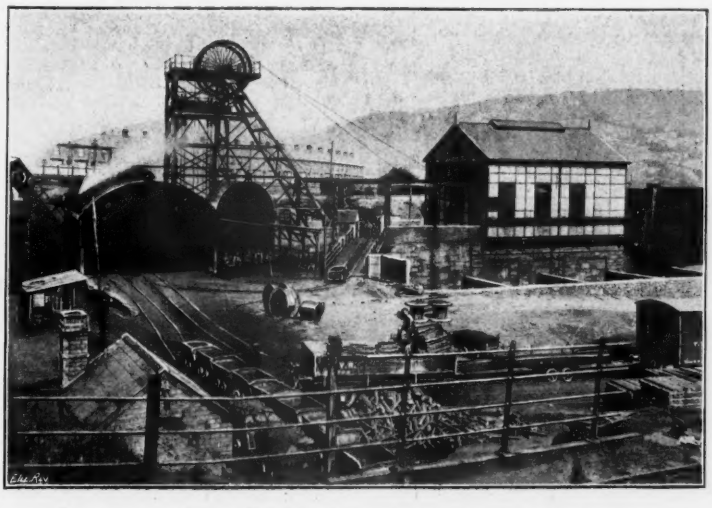
# ELECTRICAL WINDING IN SOUTH WALES.

What may fairly be described as the first electrically-driven main winder in this country, of any size, is the installation recently put to work at the Maritime pit of the Great Western Colliery Co., in South Wales, for which Mr. Gerald J. Hooghwinkel, of London, acted as consulting engineer.

The decision to adopt electric winding was due to the fact that if steam were adopted, a new steam raising plant in addition to a winder would be required, for which the cost would be great and the space did not exist. Moreover, arrangements had already been made to operate the whole of the other surface and underground plant electrically.

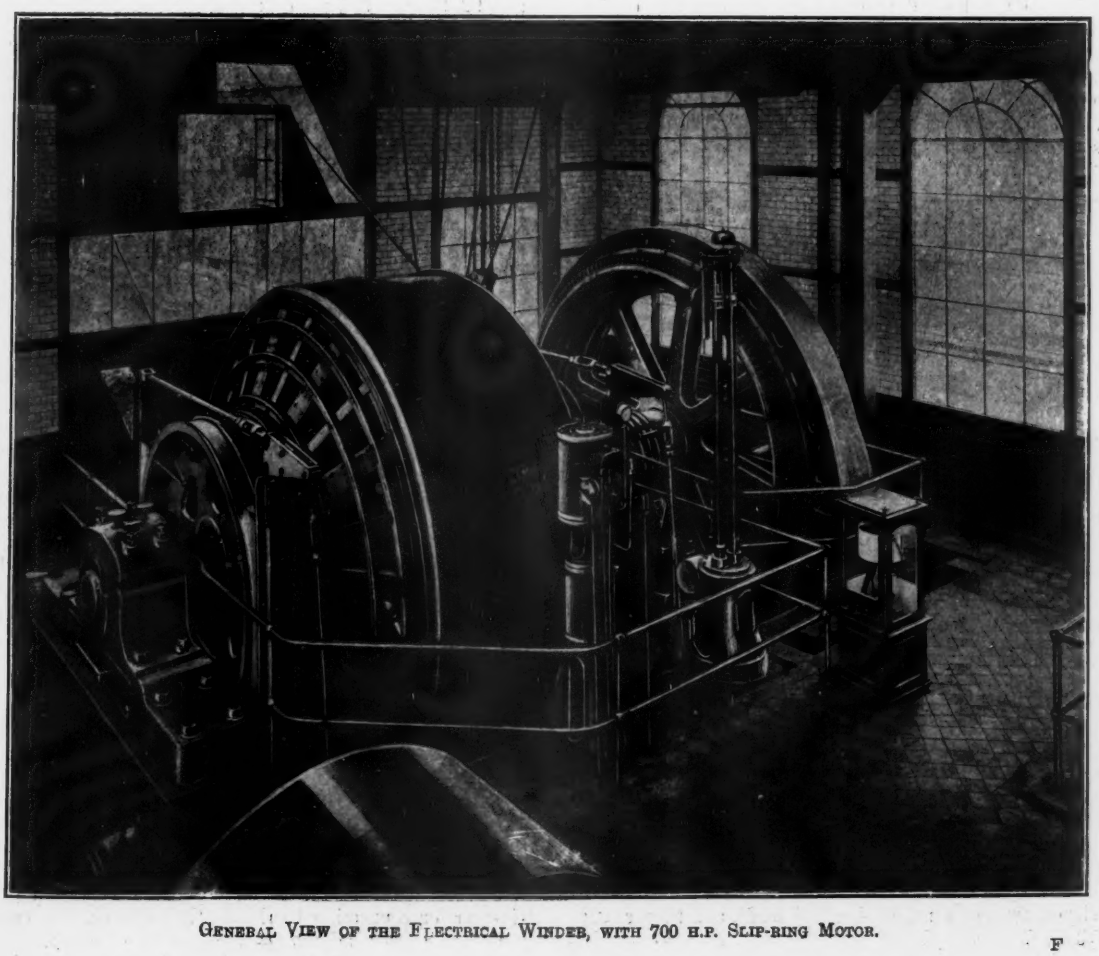
As a result of these considerations, it was found that the first cost of a complete independent steam-winding plant would be rather more than that of a suitable electrical winding plant of similar capacity. Mr. Hugh Bramwell, in a paper recently read before the South Wales Institute of Engineers, gave a detailed comparison of the first and annual costs of the two systems, which we append to this article.



Electrical Winding Engine House, &c., Great Western Colliery.

The winder was required to wind 175 tons of coal per hour from a depth of 1,110 ft. in 70 winds.

The following data as to load, &c., supplied to the various firms tendering, is also of interest:—Empty cage, chains, &c., 10,000 lb.; two trams, 2,000 lb.; average coal load, 5,600 lb.; giving an empty cage load of 12,000 lb. and a full cage load of



General View of the Electrical Winder, with 700 h.p. Slip-ring Motor.

17,600 lb. The weight of the rope on the drum at start was given as 1,560 lb. and of that in the shaft as 4,450 lb.—a total of 6,000 lb.

The winding drum specified and adopted is of a special spiro-cylindrical type, as shown in our views, and with the spiral coiling at a varying rate up the cone, at first rapidly and then more slowly. The smallest diameter is some 7·5 ft. and the largest 15 ft.

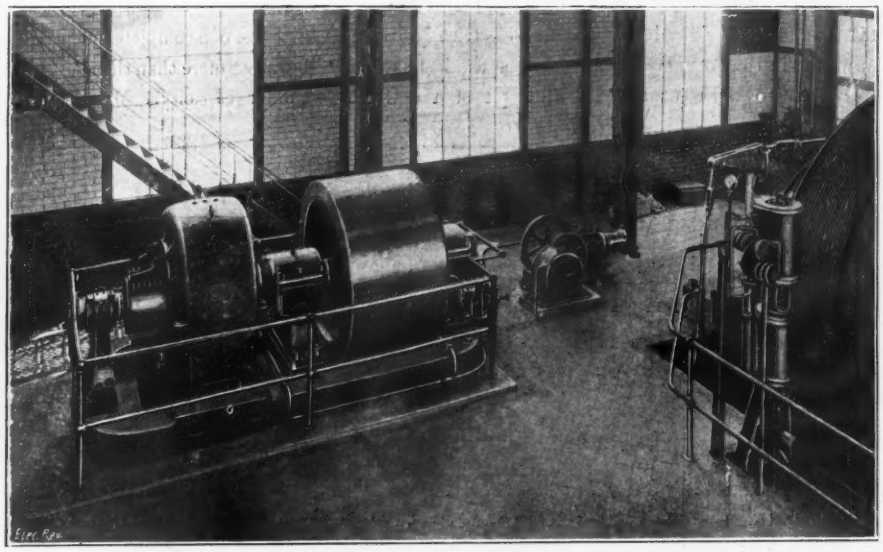
It was estimated that the use of this drum would enable the peak load during maximum acceleration to be reduced to under 1,000 H.P., as compared with some 1,450 H.P. with a plain cylindrical drum. The actual time conditions agreed to by the successful contractors, the British Westinghouse Co., were as follows :—

| | | | | |
|---|---|---|---|---|
| Period of acceleration | ... | ... | ... | 9 sec. |
| Period of constant speed | ... | ... | ... | 20½ ,, |
| Period of retardation | ... | ... | ... | 7 ,, |
| Total running time | ... | ... | ... | 36½ ,, |
| Period of changing | ... | ... | ... | 15 ,, |
| Complete cycle | ... | ... | ... | 51½ ,, |

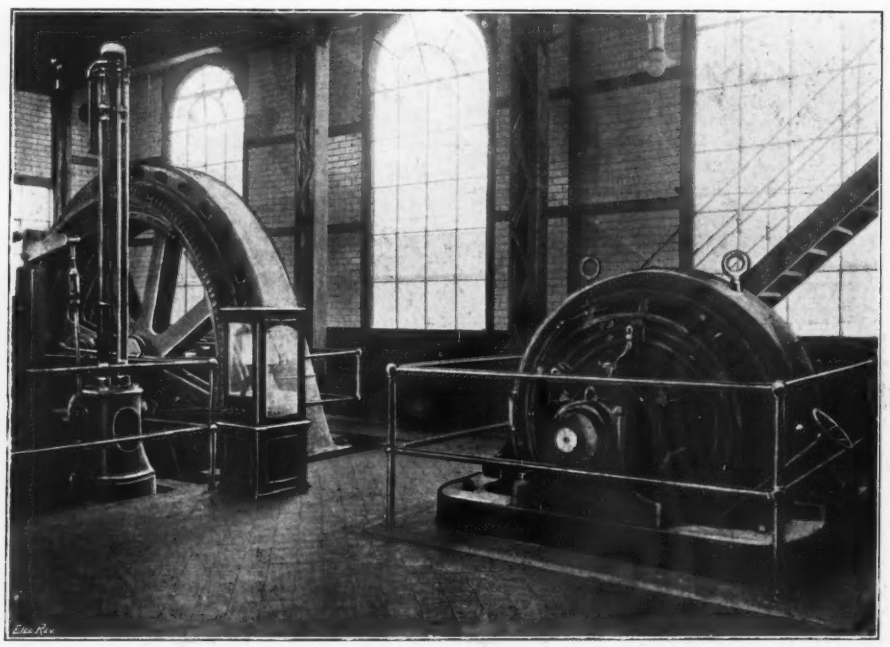
Owing to the limited space at the colliery, the engine house was constructed as a frame building with 4½-in. brick walls, pressed bricks being used with a glazed inside surface.

The plant is arranged as shown in the sectional views (page 21), and consists of :—

1. *Winding Motor*, normal rating 700 H.P. at 2,200 volts pressure, three-phase, 25 cycles, and 56 R.P.M.



FLY-WHEEL EQUALISER SET, BRAKE AIR COMPRESSOR, &C.



THE 400 KW. ROTARY CONVERTER.

Efficiency, 90 per cent., at ½ and ¾ loads, and 91 per cent. at full load.

2. *Rotary converter*, normal rating 400 KW., three-phase—550 volts D.C., 500 R.P.M. Efficiency, ½, ¾, and full loads, 87, 92½, and 94 per cent. respectively; capable of taking 100 per cent. overload during one hour.

3. *Transformer*, for above, 400 KW., 2,200-350 volts. Efficiency, ½, ¾, and full loads, 96·9, 97, and 97½ per cent. respectively; capable of taking 100 per cent. overload.

4. *Fly-wheel machine*, 250 KW., 500 volts, 500-750 R.P.M., coupled to a fly-wheel of 24,000 lb. weight, 6 ft. 1 in. diameter, and 3 ft. 6 in. wide. Efficiency, ½, ¾, and full loads, 92, 93, and 93½ per cent. respectively.

The controlling gear consists of :—

1. *A liquid-starter combined with a three-pole reversing switch* suitable for starting, reversing, and regulating the winding-motor. This starter is of special type, consisting of two large tanks, one of which contains the blades, and the other serves as a reservoir for the liquid. The two tanks are fixed one over the other, and are connected by inlet and outlet pipes, and the water is forced by an electrically-driven centrifugal-pump from the lower to the higher tank, circulating continually between the two.

An overflow is provided in the upper tank, which, if raised, causes the liquid to rise, so that by means of it the level of the same can be adjusted.

The overflow is mechanically connected to the reversing-switch and to the main lever on the driver's platform.

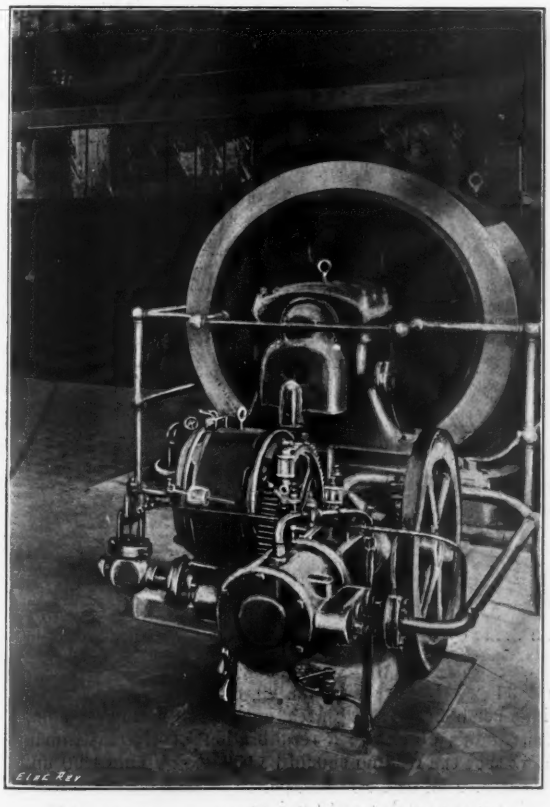
2. *An Emergency Switch* (three-phase, oil immersed) arranged to break 400 amperes at 2,200 volts, and provided with electrical and mechanical overload release, and with trip-gear for connecting to the depth indicator, the emergency brake lever and the no-voltage release magnet.

3. *No-voltage Release Magnet.*—This is a three-phase

magnet connected to the secondary of a transformer whose primary is connected to the main H.T. circuit. This magnet is mechanically connected to the emergency switch, and acts as a minimum release in case of no-voltage, or in case the voltage drops below a certain minimum.

4. 12-*KW.* 2,200-220-*volt Three-phase Transformer.*—The primary of this transformer is connected to the main H.T. circuit, the secondary supplying energy to the brake magnet mentioned above, and to the motor driving the centrifugal pump in the liquid starter, and also the 3-H.P. air compressor motor.

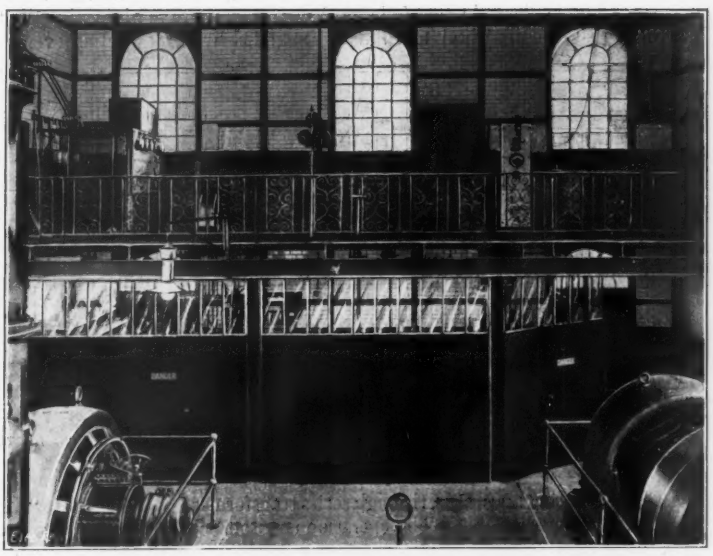
The brakes, which are linked to the drum, are operated by compressed air, or, in case of emergency, by means of a heavily weighted lever. The whole control gear is operated by means of three levers which are fixed on the driver's platform. One lever is for actuating the primary reversing-switch and the liquid rheostat. The action of the liquid-starter is such that the acceleration is automatic and quite independent of the speed with which the operating-handle is moved. The action of the lever is such that first the primary switch is actuated and then the liquid starter. If the lever is moved to an intermediate position, the primary switch is operated as previously described, while the liquid starter only moves into a position corresponding to that of the handle. In this manner the speed of the winding engine can be varied within any limits up to full speed. The design of the control gear is such that counter current can be given to the motor when lowering, if necessary.



The Motor-Driven Compressor for the Brakes.

The second lever on the left-hand side of the driver operates the power brake.

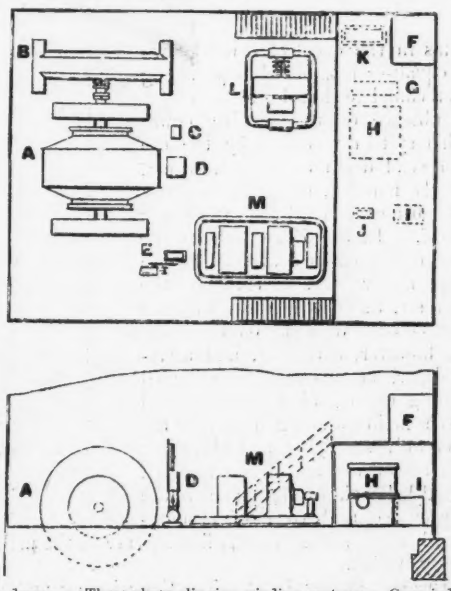
The third lever, which is in a central position, is only operated by the driver in case of emergency, and allows of the release of the weighted end of the brake lever through a tripping device, also bringing the emergency switch to the "off" position by means of rods and links, and thus interrupting the circuit of the motor.



View of the Switch Gallery.

The same action is obtained automatically through the tripping mechanism of the emergency brake lever, which is connected mechanically to the depth-indicator by means of rods and links, so that the emergency brake can be tripped at the end of the travel in case of over-winding; the emergency switch being operated at the same time through suitable links. Also by the releasing of the gear by a solenoid (which occurs in case the line voltage drops below a certain limit).

*Control-gear for the Load Equalising Set and Fly-wheel Machine Automatic Field Regulator.*—This automatically regulates the voltage of the machine by varying the resistance in the field circuit; it includes (1) an automatic regulator of the liquid type, containing two electrodes, one of which is fixed, and the other attached to a movable rod, the motion of which is controlled by a simple three-phase magnet. This magnet receives energy from the secondary of (2) a three-phase transformer.




Rope drum; B, Three-phase slip-ring winding motor; C, Cage indicator; D, Compressed air brake; E, Air compressor; F, Switchboard on engine man's platform; G, Oil-break reversing switches; H, Water resistance; J, Liquid starter for fly-wheel equaliser set; J, Automatic field regulator; K, Transformer, 2,200/440 volts; L, Rotary converter; M, Equaliser fly-wheel set.

Plan showing Arrangement of Electrical Winding Plant.

A switch (3) for short-circuiting the motor-magnet, and (4) a field rheostat, hand operating, with about 80 contacts.

A liquid starter is also provided for the D.C. fly-wheel machine.

The operation of the plant is as follows: The rotary converter on its D.C. side is connected to the D.C. fly-wheel machine, and delivers automatically the magnetising current which is consumed by the induction (winding) motor.

The voltage of the fly-wheel machine is controlled by a quick-acting regulating apparatus, through series transformers from the H.T. transmission line. The operation is automatic, so that the converter equaliser discharges its energy into the H.T. system whenever the load of same is higher than the constant station output, and it stores energy in the fly-wheel when the power demand in the H.T. supply system is less than the constant output of the station. At no load the rotary converter is acting at 100 per cent. power factor, giving the total constant capacity into the fly-wheel until it has come to its maximum speed. The capacity of the fly-wheel is taken large enough in order to take care of the overload and underload periods of the winding motor.

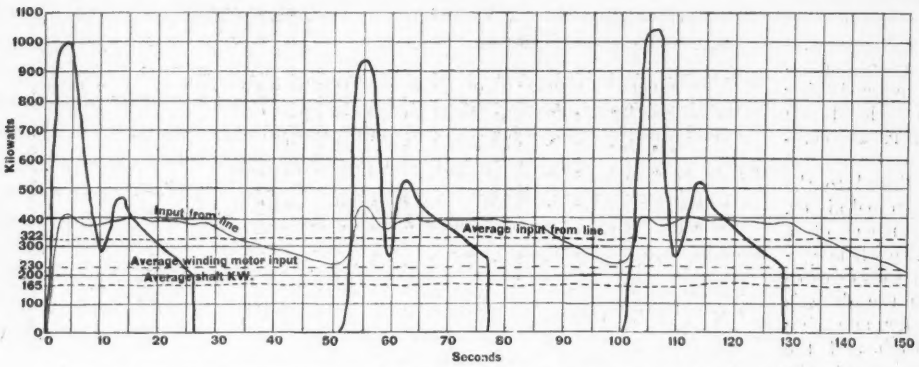



Diagram showing Performance of Converter Equaliser System of Electrical Winder; Test on November 18th, 1908.

Mr. Hooghwinkel, from whose recent paper before the South Wales Institute of Engineers we have abstracted much of the foregoing, says that the decision to adopt the Westinghouse in preference to the Ilgner system, was mainly that in the former a three-phase motor is used, capable of being run direct from the mains in the event of a breakdown of the equaliser set, and thus providing against a complete shut down.

The absence of recuperative power with this system was met by the use of the special drum mentioned, which, if properly handled, stops without any breaking being required after the power is cut off. In the Ilgner system the total fluctuating power demanded by the winding motor passes through the equaliser set, which is in series with the winding motor. With the Westinghouse system, however, a smaller, and therefore cheaper, arrangement is obtained by running the equaliser set in parallel with the main winding motor — the equaliser only supplying and absorbing the amount of surplus power required above and below the average, much in the same way as a battery of accumulators with a reversible booster, floating across the mains in a tramway station.

The rheostatic losses in starting the winding motor are not avoided with this system, but are counterbalanced by the smaller losses in the equaliser set.

In order to still further reduce the weight of the fly-wheel, the speed range of the latter is increased by driving it by a separate generator, *i.e.*, the compounded rotary converter, which incidentally enables the colliery power factor to be greatly improved, owing to the possibility of supplying a leading current to counterbalance the very low power factors of the heavy haulages.

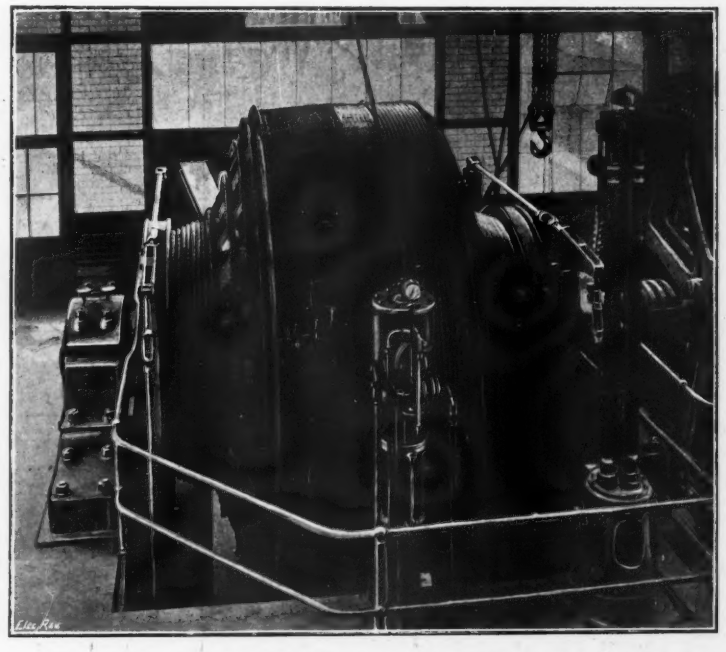
Mr. Hooghwinkel points out that the various systems of electrical winding have their own applications and advantages.

Thus the Ilgner system returns energy during braking, avoids heavy starting losses and is more easily controlled; while the Westinghouse system ensures the possibility of winding even with a disabled equalising set, and it provides for a higher power factor. The avoidance of a complete stoppage is, of course, of the greatest importance from the mining engineers' point of view.

The plant has been in continual use for about five months —although owing to the undeveloped state of the workings it is not working at more than half its full capacity.

The performance of the plant is continuously recorded by means of "Karlick" indicator diagrams which give a reliable record of the winding operations.

In order to confirm the guaranteed figures (*i.e.*, that the energy required when raising coal loads of $2\frac{1}{2}$ tons at the rate of 70 winds per hour, with a decking period not greater than 15 seconds, shall not exceed 341 KW.-hours per hour—but with a margin of 10 units over and under that amount, within which no bonus or penalty shall be due) various tests have been made. A test was made on November 18th under the nearest conditions to full load, which could be obtained, and 34 winds were made in 29 minutes, or practically 70 winds per hour. A rough reading of 140 units or 4·1 units per trip was obtained; a recalibration of the instruments shows that the reading should be 159 units giving 1·99 units per ton of coal, or 4·98 units per trip.



View showing the Spiro-Cylindrical Drum used with the Winder.

This corresponds to 348 units per hour, a figure in excess of the guaranteed 341 units, but within the allowed margin; and due allowance has to be made for the coal load only amounting to 2·35 tons instead of 2·5 tons, which it is considered would account for the difference.

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Energy for the operation of the winder is obtained from the Consumers' Co. of the South Wales Power Co. at a price slightly in excess of ½d. per unit, being fed in by a 2,200-volt overhead transmission line to a local distribution station. The latter is equipped with both H.T. and L.T. switchboards, and supplies the whole of the colliery equipment, which will include surface motors amounting to 370 H.P., 100 and 250 H.P. underground haulages, &c. In conclusion, we are indebted to Mr. Gerald Hooghwinkel, under whose advice the electrical equipment of the colliery and winding plant has been carried out, for his assistance in preparing this article; both Mr. Hooghwinkel's and Mr. Bramwell's published papers on the subject have been drawn on, and the appended comparison of costs for the Maritime winding plant are taken from the latter gentleman's paper:—

MARITIME WINDING PLANT.—COMPARISON BETWEEN FIRST COST AND ANNUAL COST OF A STEAM AND ELECTRICAL WINDER, TO RAISE 175 TONS PER HOUR, ASSUMED TO RAISE 300,000 TONS PER ANNUM.

STEAM WINDER.

*First Cost.*

| | | | | | | |
|---|---|---|---|---|---|---|
| High-class, twin-compound steam winder, guaranteed to run 70 trips per hour on a steam consumption of 7,800 lb. or 108 lb. per wind, equivalent to 35½ lb. per useful H.P. | | | | | | |
| Engine house and pillars, other than deep foundations, crane, sundry extras and erection. | | | | | | |
| Boiler plant of three Lancashire 30 ft. × 8½ ft. boilers, bunkers, flues, seating, economiser, chimney, feed pumps, steam pipes and covering, boiler shed, coal and ash plant, and sundry labour. | | | | | | |
| Complete plant as above, as per tenders and estimates ... ... ... ... ... ... | | | | £12,000 | 0 | 0 |

*Annual Cost.*

| | | | | | | |
|---|---|---|---|---|---|---|
| *Engine Room*— | £ | s. | d. | £ | s. | d. |
| Wages, 3 enginemen and 1 cleaner ... | 475 | 0 | 0 | | | |
| Ropes, estimated life, 2 years ... | 80 | 0 | 0 | | | |
| Stores of all descriptions ... ... | 50 | 0 | 0 | | | |
| | | | | 605 | 0 | 0 |
| *Steam Supply*— | | | | | | |
| Wages, 3 stokers and 1 coal and ash man ... ... ... ... ... | 335 | 8 | 0 | | | |
| Cleaning flues, 24 times at 13s. ... | 15 | 12 | 0 | | | |
| Preparing boilers for annual inspection, 3 at 35s ... ... ... | 5 | 5 | 0 | | | |
| Stripping boilers every five years, three fifths at £10 ... ... ... | 6 | 0 | 0 | | | |
| Firebars and sundry maintenance, 3 at £10 ... ... ... ... | 30 | 0 | 0 | | | |
| Stores, viz., rings, glasses, oil, waste, &c., 3 at £5 ... ... ... ... | 15 | 0 | 0 | | | |
| Maintenance and cleaning of economiser ... ... ... ... ... | 50 | 0 | 0 | | | |
| Maintenance of pumps, pipes and covering ... ... ... ... | 50 | 0 | 0 | | | |
| Coal, 3,000 tons per annum, at 7s. 6d. | 1,125 | 0 | 0 | | | |
| | | | | 1,632 | 5 | 0 |
| *Depreciation*— | | | | | | |
| 5 per cent. on £12,000... ... ... | | | | 600 | 0 | 0 |
| | | | | £2,837 | 5 | 0 |

On 300,000 tons per annum = 2·23d. per ton.

ELECTRICAL WINDER.

*First Cost.*

| | | | | | | |
|---|---|---|---|---|---|---|
| Converter-equaliser three-phase winder, guaranteed to run 70 trips per hour on a consumption of 336 units, equivalent to 4·8 units per wind. | | | | | | |
| Engine-house and pillars, other than deep foundations, crane, sundry extras, erection and testing. | | | | | | |
| Share of cost of electrical sub-station and transmission line from same to engine-house. | | | | | | |
| Power to be purchased from power company. | | | | | | |
| Complete plant as above, as per tender and estimates | | | | £11,000 | 0 | 0 |

*Annual Cost.*

| | | | | | | |
|---|---|---|---|---|---|---|
| *Engine-room*— | | £ | s. | d. | £ | s. d. |
| Wages, 3 enginemen and 1 cleaner ... | | 475 | 0 | 0 | | |
| Ropes, estimated life 2½ years ... | | 65 | 0 | 0 | | |
| Stores of all descriptions ... ... | | 50 | 0 | 0 | | |
| | | | | | 590 | 0 0 |
| *Electrical supply*— | | | | | | |
| 1,950 hours running | 655,200 units | | | | | |
| 5,250 hours waiting | 183,750 „ | | | | | |
| 1,560 hours shut down | nil „ | | | | | |
| Total units per annum | 838,950 „ | | | | | |
| 838,950 units at ⅛d. ... ... | | 1,747 | 16 | 3 | 1,747 | 16 3 |
| *Depreciation*— | | | | | | |
| 5 per cent. on £11,000 ... ... ... ... | | | | | 550 | 0 0 |
| | | | | | £2,887 | 16 3 |

On 300,000 tons per annum = 2·31d. per ton.

# TRAMWAY and RAILWAY NOTES.

(*Continued from page* 18.)

**Edinburgh.**—The tramway company has decided to give its employés, who have served 10 years, a stripe, which carries with it increased pay; merit medals are also to be introduced in recognition of any special act on the part of an employé.

**Falmouth.**—An application has been made to the Corporation for permission to start a system of railless electric traction. It is thought that the streets of Falmouth are too narrow to permit of rails being laid, because of the interference with ordinary traffic. At present there are no means of conveying visitors and inhabitants from the different parts of the town to the beach, and it is intended to supersede the present slow omnibus system of communication between Penryn and Falmouth. It is proposed that the route shall be from Falmouth railway station, through the main street, and along the main road to Penryn, terminating at a point near Penryn Town Hall, or, if reason can be shown for it, at the railway station; a branch line would extend to the beach, and thence along the sea front. It is hoped to be able to secure the current required from the Falmouth Electric Light Works. An effort will be made by the parent company to form a local company to finance the scheme.

**Glasgow.**—The T.C. has decided to allow to lie on the table the following resolution recently passed by members of the Citizens' Union:—"That, as the tramway undertaking is competitive in character, this meeting is opposed to the clause in the new prov. order which will have the effect of making the ratepayers liable for any loss on the said undertaking."

**Heywood.**—The Corporation Bill, which was issued on December 24th from the Private Bill Office of Parliament, seeks power to borrow £13,500 for tramway extensions, £10,000 for gas works, and £10,000 for the supply of electric fittings and motors and for wiring houses. The tramways portion of the Bill provides for inter-running with the Bury and Rochdale Corporation tramways, a provision which is duplicated in the Bury Bill.

**London.**—A good deal of reconstruction has been carried out at the various District Railway stations during the past year or two, the roofs in particular having been reconstructed in verandah form. The latest station to be taken in hand is St. James's Park, which is to be covered by new office buildings, in which it is hoped to place the whole of the staff of the Underground Railways Co.

HIGHGATE HILL.—On the 29th ult., the brakes of a cable car, running down the hill, refused to act, and it collided with a stationary car at the bottom. Fortunately, the driver had sufficient presence of mind to keep the gripper on the cable, and as a result, the car only travelled at the speed of the latter, some six miles an hour. No one was injured.

**Morecambe.**—An inquiry has been opened at the Surveyors' Institute, London, to determine the value of the Morecambe tramways which the Corporation desires to purchase.

**North and South Shields.**—Our Newcastle correspondent writes that the scheme, which has been in abeyance for some considerable time, for constructing a tube railway under the River Tyne to be worked electrically, is being revived, and there seems to be more likelihood of its being persevered in than there has previously been. The North and South Shields Electric Railway Co. have already acquired Parliamentary powers, and although it would seem as if little progress had been made hitherto, negotiations have been under way, and it is now stated on good authority that the promotion of the scheme has been entrusted to Mr. Schenk, a well-known financial expert. That gentleman, it is stated, estimates

that the capital necessary to start the undertaking will be about £200,000, and it is suggested that the Corporations of South Shields and Tynemouth should provide the first £100,000, each contributing according to its rateable value, which would mean that South Shields would contribute £65,000 and Tynemouth £35,000. It is stated that it is proposed that the capital subscribed by the Corporations should be the first charge on the undertaking, so that the promoters would repay to the Corporations an amount equivalent to interest and redemption on the respective sums borrowed before taking any profit. As to the second £100,000, Mr. Schenk is hopeful that it may be raised in London. In addition to making a convenient means of communication between the two towns, it is also suggested that connections should be made between the tube and the railway termini in the two towns named. This latter would mean a very useful railway connection between the coast lines in Northumberland and Durham counties.

**Portsmouth.**—Renewals promise to be a heavy tax on the Corporation tramway undertaking during the next few years. Last year a profit of £13,132 was made, but of this £9,351 had to be transferred to the renewals fund. There was no contribution in relief of rates, such as had been made in former years, as £2,500 was added to a reserve and insurance fund, £373 contributed to capital expenditure, and £907 was carried forward. The estimates for renewals for the next few years are also rather heavy, although for the ensuing year only £1,225 is set down; but the following year £5,831 will be required, in 1911 £19,704, and in 1913 £42,241.

**Preston.**—The Corporation Tramways Committee has decided to oppose the Preston, Chorley and Horwich Tramways Bill, 1909.

**Rossendale.**—A serious run-back accident occurred on Xmas eve, at Haslingden. Fortunately electric traction is blameless in the matter, as the car which hastened to destruction was a steam-driven one, from which the engine had been detached for the purpose of changing ends, and which ran back down a hill, crashing into an empty stationary car at the bottom. Both cars were badly damaged, and of two passengers who attempted to jump out one was killed and the other injured.

**Southport and Lytham.**—The scheme for connecting Southport and Lytham by a tramway, with a conveyor bridge across the River Ribble, has been abandoned. The promoters obtained their powers after a prolonged struggle with the Preston Corporation (who have navigation rights in the Ribble), but the capital necessary for carrying out the scheme, it appears, cannot be raised. The Widnes and Runcorn conveyor bridge over the River Mersey, which was projected at a later date, has already been carried out.

**The Snowstorm.**—Reports from every part of the country show that the car services in all the large centres were either delayed or suspended, owing to the heavy fall of snow during the past few days. The L.C.C. conduit service suffered severely.

**York.**—The Tramways Committee has decided to take over the tramways from the company on January 19th, or on the date of the actual completion of the purchase of the undertaking, and to run the same under its own management. With a view to installing the new electric service, the Committee recommends the Council to give the notices to treat for property, and the other necessary preparations are being made.

## TELEGRAPH and TELEPHONE NOTES.

**British Guiana.**—The Colonial Report for 1907-8 states that the electrical services—telegraphs and telephones—have been satisfactorily maintained, and the revenue has also been good. The total number of messages sent over the telegraph lines was 68,758, compared with 65,985 in 1906-7. The total receipts from telegraphs and telephones during the year were £4,899. It is also stated that the maintenance of the telegraph service in the Colony is complicated by the large swift-flowing rivers that have to be crossed by cable.

One would have expected some reference to the state of cable communication and the erection of a wireless station, in connection with which an expert has just arrived at Georgetown. The system adopted is the Lodge-Muirhead, and the telegraph company serving the Colony has secured a renewal for five years of the cable subsidy by erecting the wireless system as an adjunct to the present decrepit cable. Agitation is still proceeding for the establishment of an Imperial cable system, and in the scheme provision has been made for an all-British cable "*via* Bermuda." British Guiana is tired of paying 7s. a word for a message to London.

**Merton.**—The District Council has decided to adopt the "Gamewell" system of fire alarms, which the Post Office authorities are to supply and maintain for 10 years at an annual rental of £66.

**"Money-back" Telephone.**—According to the *Daily Mail*, the Post Office authorities have devised a call-box apparatus which will overcome the difficulties hitherto experienced in the use of these public instruments. The user lifts the receiver and drops two pennies into a slot, which is only open when the receiver is raised; he then states the number required. If the latter is engaged, the attendant says so, and closes a circuit which causes the money to be returned. The time occupied in getting through is very much shorter than on the old roundabout system.

**Telegraphic Interruptions :—**

| | | | | |
|---|---|---|---|---|
| Port Arthur-Chifu | ... | ... | ... | ... March 9, 1904 |
| Pontianak-Saigon | ... | ... | ... | ... Sept. 16, 1908 |
| Medan-Penang | ... | ... | ... | ... Dec. 22, 1908 |

**Wireless Telegraphy.**—Considerable additions, says the *Pall Mall Gazette*, are being made to the wireless telegraph station on Horsey Island, near Porchester. Under the new coastguard system, there are to be a number of signal stations, all equipped with wireless, around the coasts. They will be war stations, manned by trained naval signallers, and always at full strength. Horsey Island will be the chief link in this chain.

We regret that the range of the Marconi multiple tuner mentioned in our last issue was given as 300 to 800 ft., instead of 300 to 8,000 ft.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Algeria.**—January 15th. Tenders are invited by the Bône municipal authorities for—(1) the construction and working of a central electric power station, and (2) the construction and working of an electric tramway. Copies of the projects, specifications, &c. (in French), may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

**Australia.**—SYDNEY, N.S.W.—April 28th, 1909. The Postmaster-General requires tenders for the supply, erection, &c., of a branching metallic multiple magneto switchboard at the William Street telephone exchange, according to specification No. 236. Specification may be seen at the ELECTRICAL REVIEW Office. Also see our "Official Notices" December 18th.

SYDNEY.—February 22nd. Five water-tube boilers, economisers, stokers, feed pumps, pipework, &c., for the Council's electricity department. See "Official Notices" December 11th.

SYDNEY.—March 1st. Two 1,000-KW. and two 600-KW. motor-generators with starting and regulating apparatus for the Municipal Council. See "Official Notices" to-day.

**Beckenham.**—January 4th. Electricity meters for the U.D.C. See "Official Notices" December 18th.

**Belgium.**—BRUSSELS.—January 8th. The Palais de Cinquantenaire electric lighting installation is to be adjudicated on January 8th, 1909; a deposit of £18 is required. Specification No. 89 may be obtained for 3d. and plans for 4s. 2d., at 15, Rue des Augustins.

January 15th.—The company responsible for the 1910 Exhibition requires tenders for the supply of motive power and lighting during the time the exhibition is open, and some months before the official opening and after the closing. Particulars may be obtained from the Secretaire de le Compagnie de l'Exposition de Bruxelles, 1910, No. 34, Rue des Douze-Apôtres.

**Brazil.**—The municipal authorities of Puerto-Alegre are about to invite tenders for the concession for the electric lighting of the town.

**Cardiff.**—January 26th. Electrical work required at the new factory to be erected by the Boston Collapsible Barrell and Manufacturing Co., Ltd. See "Official Notices" to-day.

**Fareham.**—January 20th. Three alternators and exciters, high and low-pressure switchboards, and overhead travelling crane, for the Council. See "Official Notices" December 18th.

**France.**—PARIS.—The director of the Central Depôt of Military Telegraphs, 51 bis, Boulevard de la Tour Maubeuge, requires tenders for 200 microphone outfits for field or camp work (without microphones).

**Germany.**—NEU BUCKOW.—January 6th. A light and power installation at the new hospital is required. Specifications may be obtained, for 3s., at the Rathaus, Schönestedstrasse 1-5, at Rixdorf.

ALTONA.—January 9th. The Government Railways Administration requires tenders for 16,265 carbon-filament lamps, according to specifications, obtainable against 6d. cash or P.O., from the Zentralbureau der K. Eisenbahnverwaltung.

January 26th.—The Finance Deputation of Hamburg is inviting tenders for the supply and erection of 43 electrical cranes on the quays.

The municipal authorities of Rodewisch-in-Vogtland are at present inviting tenders for the establishment of an electric lighting station in the town.

**Grimsby.**—January 16th. D.C. motors and starting panels (sizes ¼ to 15 H.P.) for the Corporation. See "Official Notices" to-day.

**India.**—MADRAS.—January 26th. Twenty-four arc lamp posts and accessories, laying connecting cables; also 32 lamp-posts, &c., for incandescent lighting. Specifications and other documents from the Engineer of the Works Department, Madras, Rs. 10 each. —*Board of Trade Journal.*

**Italy.**—ROME.—February 8th. Tenders are required for the lighting of the Palais de Justice, including fittings. Inquiry must be made, through local agent, at the chief engineer's office for the General Service of Rome, Department of Public Instruction.

**Leith.**—January 6th. One 600-KW. steam dynamo for the Corporation electricity department. See "Official Notices" December 18th.

**Middlesbrough.**—January 4th. Twenty flame arc lamps, posts, &c., for street lighting. See "Official Notices" December 18th. The date has been extended from December 30th.

**Portsmouth.**—January 4th. Materials for Corporation tramways construction. See "Official Notices" December 18th.

**Russia.**—BAKU.—January 24th. The T.C. is inviting tenders for its electric tramway concession (42 years). Full particulars at the Russian Consulate in London.

**West Ham.**—January 21st. Electrical and other supplies for the Council. See "Official Notices" to-day.

## CLOSED.

**Aberdeen.**—The Electricity Committee has accepted a number of tenders for general stores.

**Dover.**—The T.C. has accepted the tender of Messrs. Glover & Co. for 3,200 yards of cable on condition that they reduce their price from £502 19s. to £500.

**Glasgow.**—The Tramways Committee has accepted the following tenders:—

Ash chute, Pinkston.—Bryden & Middleton.
Several works, "roofing," new sub-station.—J. Baxter & Son.
Travelling crane, new sub-station.—Alexander Jack & Co.
Steel beams, new sub-station.—Fleming Bros.
Trolley wire.—National Conduit & Cable Co.
Dry cells.—Siemens Bros. Dynamo Works, Ltd.

**Gravesend.**—The Education Committee has accepted the tender of Messrs. F. A. Glover & Co., Ltd., for installing the electric light at Cecil Road Schools, at £234.

**London.**—WESTMINSTER.—The City Council has accepted the tender of the Easton Lift Co., Ltd., at £58 10s., for repairs to the lift at the City Hall.

The City of London Guardians have placed an order with Messrs. Pinching & Walton for 1 gross 16-C.P. lamps, at £5 5s.; ½ gross 8-C.P. lamps, at £2 12s. 6d.; ¼ gross 25-C.P. lamps, at £1 6s. 3d.; ¼ gross 32-C.P. lamps, at £1 9s. 3d.; and 12 Osram lamps, at £2 8s.

**Mexboro'.**—The Board of Governors of the Secondary School recently opened the tenders for the installation of electric lighting at the new school. There were in all ten tenders received in response to the 14 invitations which had been sent out. The local paper says that "The tenders gave as separate items the amounts charged for wiring and fittings, in accordance with the specifications. There was a vast difference in the prices for wiring. One tender was for £186, whilst another charged £520 for the same item! There were but slight variations in the prices for fittings."

| | | | |
|---|---|---|---|
| Pullan, Bradford .. .. .. | £490 | Rooper & Co., Stafford .. .. | £616 |
| Charles Fisher, Doncaster .. | 486 | Furse, Nottingham .. .. | 622 |
| **Cockayne**, Sheffield .. .. | 571 | Arnold & Son, Newport .. .. | 704 |
| Mansfield Engineering Co. .. | 578 | Snowden & Sons, Barnsley .. | 715 |
| Walsh, Sheffield .. .. .. | 605 | Tasker, Sheffield .. .. .. | 814 |

After considering the above tenders, the Committee decided to accept that of Messrs. Cockayne, of Sheffield. The lighting scheme provides for 281 lights, distributed as follows:—Ground floor, 135; first floor, 127; basement, 19.

A correspondent draws our attention to the list of tenders as an example of the disparity in wiring tenders. The specification and schedule of prices consisted of about 20 folios of closely printed matter.

**Warrington.**—The B.G. has accepted the tender of Mr. Harry Rogers, Warrington, for the supply of electrical requisites.

**Willenhall.**—Staffs. Education Committee has accepted the tender of Messrs. Lea, Son & Co., Ltd., of Shrewsbury, for installing the electric light at the new schools in Albion Street, at £224.

## CONTRACTORS' COLUMN.

The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDARE.—Schools, at Aberdare and at Cap Coch; T. Roderick, architect, 23, Clifton Street, Aberdare.

ABERDEEN.—Premises for Deaf and Dumb Benevolent Society (£2,000). Rev. S. G. Woodrow, secretary.

ALDERLEY (CHESHIRE).—New church at Warford. Rector, Alderley Edge, Cheshire.

ALTON (HANTS.).—Convalescent home. G. Hartfree, surveyor, Alton.

ANNAN.—New manse for the Congregational Church (£500). Rev. J. M. Wright, pastor.

ASCOT.—Villas, Kennel Ride, for W. Watson, builder, High Street.

ASHCOTT (SOMERSET).—School. A. B. Cottam, architect, Bridgwater.

BANFF.—Villa in Seafield Street. J. Christie, jun., architect, Banff.

BANGOR (Co. DOWN).—New technical school and library.

BARNSLEY.—Houses, Day Street and Wall Street, for Jas. K. Taylor; Day Street and Wall Street, for Wm. Fearn; Bradbury Street, for F. & A. Dunk; Bradbury Street, for Walter Dunk; Gawber Road, for J. H. Turner; Bradbury Street, for T. Willcock; Dillington Road, for Henry Hibbert; Dodworth Road, for E. H. Wakefield; Shaw Lane and Lancaster Street, for Joseph Raynor; houses and shops, Summer Lane, for Geo. Haigh.

BARNSTAPLE.—Houses, Rackmarsh, for H. Harris, J. Rice, G. Hancock, B. Pickard, J. Cater, J. Brayley, J. Hill, J. Carter, and J. Morrish, builders; Oliver & Sons, architects, The Square, Barnstaple. Houses, Sticklepath, for W. Slee, builder, Bear Street, Barnstaple.

BARRY DOCK.—New Wesleyan Methodist Church (£4,000).

BERKELEY (GLOS.).—County school. R. S. Phillips, architect, The Cross Gloucester.

BERKHAMSTED.—Houses, North Road, for F. Young; Gossoms End, for J. Ayres; house and laundry, Lower King's Road, for D. Pike.

BILSTON.—Fourteen houses, Fraser Street; Mr. Prosser, builder.

BINGHAM (NOTTS.).—New County School (£2,388). J. Walker, builder, Bingham.

BIRMINGHAM.—Proposed police station, Allison Street (£17,000). E. O. Smith, town clerk.

BIRSTALL.—Probable re-erection (after fire) of mill premises for Geo. Hirst and Sons (Extract Wool and Merino Wool Co.), Ltd.

BISHOP AUCKLAND.—Extensions to Lady Eden Cottage Hospital. F. H. Livesay, architect, Bishop Auckland.

BISPHAM (near BLACKPOOL).—Houses, Hesketh Avenue, for J. Singleton; Hesketh Place, for T. G. Lumb; Cavendish Road, for J. Shorrock; Frederick Street, for S. Midgley; Balmoral Road, for L. Cohen.

BITTON (GLOS.).—School. R. S. Phillips, The Cross, Gloucester.

BRIDGWATER.—Additions, &c., to Town Hall (£5,300); W. T. Baker, borough surveyor. Police court and offices; F. Part, architect, Bridgwater.

BRIDLINGTON.—New chancel and organ chamber at St. Anne's Church; Brodrick, Lowther and Walker, architects, 77, Lowgate, Hull. Alterations and additions to Hilderthorpe Hotel, for Allsopp and Sons, Ltd.; Brodrick, Lowther & Walker, architects. New Burlington schools and caretaker's residence; J. Earnshaw, architect, Carlton House, Willington Road, Bridlington.

BRISTOL.—Proposed new refuse destructor for the T.C. (£16,850). Mission church, school, &c., Kingswood (£4,000); J. Mackay, architect, Kimberley Road, Kingswood, Bristol. New premises for Baker and Co., drapers, Maryport Street; Foster, Wood & Awdry, architects, 35, Park Street, College Green, Bristol.

BROMLEY.—Houses, Kinnaird Avenue, for J. A. Stayner; Lower Gravel Road, for W. Simpson; King's Avenue, for W. J. Harrington; Salisbury Road, for J. E. Masters; alterations and additions to Berryfield, Chislehurst Road, for A. Conder. Alterations to Lyric Theatre; Baxter, Payne & Lepper, architects, 10, Market Square, Bromley. Proposed new fire station; S. Hawkings, borough engineer.

BROWNHILLS.—Stables, &c., and installation of suction-gas plant, pumps, &c., for the U.D.C. J. H. Shaw, surveyor, Public Offices, Brownhills.

BUCKHAVEN.—Houses in College Street. Mr. Todd, architect, Buckhaven.

BURNLEY.—Six houses at Worsthorne for the Worsthorne Manufacturing Co. S. Keighley, architect, Nicholas Street, Burnley.

BURSLEM.—Proposed central dining hall at the workhouse. W. F. Slater, architect, Wedgwood Place, Burslem.

BUSHEY.—Houses, Glencce Road, for T. Williams; Grange Road, for C. Jaggard.

CAMBRIDGE.—Servants' Hall, Sidgwick Avenue, for the Master and Council of Selwyn College; stables and coach-house, Mount Pleasant, for A. Matthew, The Garden House, Mount Pleasant; Wesleyan Methodist Church, to replace Hobson Street Church.

CARDIFF.—New schools at St. John's, new Coal Exchange at Docks (£30,000), and six houses, Pentre Street, for D. Raymond; E. W. M. Corbett, architect, Bute Estate Office, Castle Street, Cardiff. Five houses, Kimberley Road, Williams & Hoare, builders. Nineteen houses, Amesbury Road, for J. D. Jeans; W. H. Scott, architect, 74, Stacey Road, Cardiff.

CARSHALTON.—Eight houses, Cambridge Road, for J. Peto.

CASTLEFORD.—Houses, Charles Street, for J. Nicholson; Ambler Street, for Jas. Lee.

CHADDERTON (LANCS.).—Sixteen houses, Middleton Road West, for Thomas Bros.

CHISLEHURST.—Probable re-erection (after fire) of St. Nicholas' Club premises; proposed new General Post Office.

CHOBHAM (SURREY).—Additions to schools for the C.C. (£2,720).

COVENTRY.—Twenty-four houses. C. Johnson, architect, Market Place, Coventry.

CREATON (NORTHANTS.).—Sanatorium. F. Dorman, architect, 5, Mercer's Row, Northampton.

CROYDON.—Isolation Hospital (£7,370). J. S. Killick, surveyor to Rural District Council.

CUPAR (FIFE).—Alterations and additions, for Geo. Innes, publisher, Westbank.

DARWEN.—Proposed extension of Local Infectious Diseases Hospital (£2,500). Borough Surveyor, Darwen.

DEVONPORT.—New school at Camel's Head.

DUNDEE.—Extension of General Post Office (proposed). Secretary, G.P.O., Edinburgh.

DUNHAM MASSEY.—Isolation Hospital, Sunderland Road (£8,700). W Owen, architect, Duchy Chambers, Clarence Street, Manchester.

DUNSTABLE.—School. Gotch & Saunders, architects, Bank Chambers, High Street, Kettering.

DUNTON BASSETT.—Enlargement of Council schools. Particulars from Architect, 33, Bowling Green Street, Leicester.

EARDISLAND (HEREFORD).—Laundry. E. G. Davies, architect, 7, Bridge Street, Hereford.

EARLSDON.—Residence, Warwick Avenue. F. Foster, architect, Masonic Hall, Coventry.

EASTBOURNE.—Houses, Brand Road, Hampden Park, Mitchell & Ford, architects, 7, Gildredge Road; Miller & Selmes, builders, 75, Tideswell Road; Brand Road, Hampden Park, Cornwell & Son, builders, 35, Ashford Road; Brassey Avenue, Hampden Park, H. A. Sisley, builder, 76, Langney Road; Station Road, Hampden Park, A. Chandler, architect; W. J. Cole, builder, 101, Tideswell Road; alterations and additions to Thorne House, Westham, W. H. Harrison, architect, Westminster; Peerless, Dennis & Co., builders, 4, Langney Road.

EASTLEIGH (HANTS).—House, Stoneham Lane, for Pitfield Bros.; additions to the premises of the Central Working Men's Club; alterations and additions to 82, High Street, for R. W. Jesson.

EASTWOOD (near NOTTINGHAM).—Business premises, Market Place, for the Langley Mill and Aldercar Co-operative Society. S. Taylor, architect, Nuttall, Nottingham.

ELLESMERE PORT.—New flour mill, for Frost & Son, millers, Chester.

EPSOM.—Enlargement of Technical Institute. R. Nares, secretary, Surrey Education Committee, Kingston.

EXETER.—Proposed new Church in Polsloe Park (£3,000).

FACIT (near ROCHDALE).—New Catholic day schools. Peters & Wolfenden, contractors, Rochdale.

FLEETWOOD.—Six houses, Addison Road, for J. Hindson; house, Addison Road and Stanley Road, for E. Crosby; house, Fleetwood Road, for P. J. Ollsom; twenty houses, Warrenhurst Road, for S. Tompkin; two houses, Galloway Road, for C. Currah Engineering Works; Station Road and Siding Road, for J. S. Doig & Co.; Bottling Stores, Styan Street, for R. Carter & Sons.

FOLKESTONE.—New Grammar School. A. M. Nicholls, borough engineer, Folkestone.

FRESHWATER (ISLE OF WIGHT).—Prospective rebuilding, after fire, of premises for the Capital and Counties Bank; probable re-erection (after fire) of premises, for G. H. Dowty, ironmonger and house furnisher, School Green (lit by electricity).

GLASGOW.—New Mission Hall in connection with Ibrox United Free Church, Rev. W. T. Bankhead, minister; additions to buildings, corner of Rose and West Streets, for Milton Free Church; dwelling houses and offices in Fotheringay Road, for R. Henderson, London Road, and Crawford & Eadie, house factors; nine houses, Carmunnock Road, for R. Henderson, architect, 80, Mount Annan Drive, Mount Florida, Glasgow; alterations to Nos. 72-76, Charlotte Street, for the Glasgow Eye Infirmary; offices and warehouses, 35, Oswald Street, for Stewarts and Lloyds, Ltd.

GREAT HARWOOD (LANCS.).—Fifteen houses, Arthur Street, for W. Griffiths.

HALSTEAD (ESSEX).—School (£6,000). Essex County Council, Chelmsford.

HEREFORD.—Premises for W. H. Smith & Son; Groome & Bettington, architects, Palace Chambers, King Street, Hereford. Additions to Corn Exchange; Groome & Bettington.

HOUNSLOW.—Laundry, London Road; C. H. Samson, architect, The Laurels, Taunton. Cemetery chapel, Sutton Lane; N. Parr & A. E. Kates, architects, Brunswick House, Brentford.

HYDE.—Ten houses, Thistley Field, for J. Widdowson; five houses, Mottram Old Road, for A. Pearson; seven houses, Hudson Road, for S. Robinson & Sons; additions to works, for the British Leather Cloth Manufacturing Co., Ltd., Newton.

ILFORD.—Caretaker's house, South Park School, for the Education Committee. C. J. Dawson, architect, 11, Cranbrook Road, Ilford.

JOHNSTONE, N.B.—New Baptist Church, for Pastor Damant.

KINGSTON-ON-THAMES.—New St. Andrew's Church. W. T. Lowdell, architect, 25, John Street, Bedford Row, W.C.

LATCHINGTON (ESSEX).—New Congregational Church (£500).

LEICESTER.—Schools and Institute in connection with Victoria Road Church (£10,000), Rev. P. T. Thomson, pastor; factory premises, A. Hall, architect, 8, St. Martin's, Leicester; Institute, club rooms, &c., G. L. Brown, architect, 4, Market Place, Leicester.

LEITH.—Proposed new dry dock (£400,000). Works Committee of the Leith Dry Dock Commission.

LEVENSHULME.—Houses, Woodlands Road, for H. M. Emery; extensions to carpet works, Highfield Road, for W. Millward & Sons. Houses, Brook Avenue, for Joseph Holt; J. Earnshaw & Sons, architects, King Street, Manchester.

LITTLEBOROUGH.—Sewage works developments. Surveyor, Council Offices, Littleborough.

LIVERPOOL (SEACOMBE).—Prospective restoration, after fire, of the Irving Theatre.

LLANDRINDOD WELLS.—Proposed pavilion for the U.D.C.; R. Wellings Thomas & W. Alec Millward, architects. Houses, Gorse Lane, for Morgan Morris & J. E. Parry.

LOFTUS (YORKS.).—Twenty-five houses, Mount Pleasant, Carlin How, for Nixon Bros., Brotton; 14 houses, Kennedy Crescent, Carlin How, for Oates & Co.

LONDON (GOLDER'S GREEN, N.W.).—Church (£2,000). Wills & Anderson, architects, 4 and 5, Adam Street, Adelphi, W.C.

(HENDON, N.W.).—Enlargement of Bell Lane School; Mr. Wilson, architect, Hendon Education Committee. Proposed new infirmary and phthisis wards, and conversion of present infirmary into wards for the infirm; Clerk to Hendon Board of Guardians. Club room, Town Square, Hampstead Garden Suburb; E. L. Lutyens, architect, 29, Bloomsbury Square, W.C.

(E.C.).—Addition at the *Times* printing office, 162, Queen Victoria Street, E.C.; H. O. Ellis, architect, 46, Fenchurch Street, E.C. Alterations to Nos. 15 and 16, Old Change, and buildings in Carter Lane, Knightrider Court and Knightrider Street; J. D. Mathews & Son, architects, 11, Dowgate Hill, E.C. Alterations for additional office accommodation for L.C.C. Tramways Department at Evelyn House, Finsbury Pavement (£250); W. E. Riley, architect to the L.C.C. Alterations to 59 and 61, Fleet Street, and 2, Pleydell Street; R. M. Roe, architect, Bassishaw House, Basinghall Street, E.C.

(W.C.).—Alterations to 223-226, Tottenham Court Road, and 22, Store Street; A. H. Heron, architect, 27A, Sackville Street, London, W. Buildings on site of 61 and 62, Lincoln's Inn Fields; R. Stafford Charles, surveyor, 2, Broad Street Place, E.C.

(STEPNEY, E.).—Adaptation of St. Cecilia's House, Commercial Road, as Domestic Economy Centre (£260). T. J. Bailey, architect to the L.C.C. Education Committee.

(CAMBERWELL, S.E.).—New fire station in Foxley Road, for L.C.C. John Barker & Co., Ltd., builders, 83, Kensington High Street, W.

LONDON (N.).—Adaptation of disused fire station, No. 32, Seven Sisters Road, for commercial purposes. Gilbert & How, auctioneers, 5, Crouch Hill, N.

(HACKNEY, N.E.).—Conversion of disused tramway property as stores depot for L.C.C. (electrical goods lift to be installed); W. E. Riley, superintendent architect to the L.C.C., County Hall, S.W. Buildings in Mare Street, Nos. 14 to 17; C. Winkley, estate agent, 112, Teesdale Street, Hackney Road, N.E.

(WANDSWORTH, S.W.).—School in Hitherfield Road; T. J. Bailey, Education architect, L.C.C. Offices, Victoria Embankment, W.C.

(WESTMINSTER, S.W.).—Accommodation for lady members at Spring Gardens, (£345). W. E. Riley, architect to the L.C.C.

(BRIXTON, S.W.).—School on the "Reay" site. T. J. Bailey, Education Architect, L.C.C. Offices, Victoria Embankment, W.C.

(FINSBURY, E.C.).—Electrical installation at Northampton Polytechnic (£5,600). The Governors.

(PECKHAM, S.E.).—Prospective rebuilding (after fire) of factory in Glengall Road, for the Edison-Bell Phonograph Record Co.

(WALTHAMSTOW).—New school at Forest Rise, for the Essex Education Committee.

(EAST HAM, E.).—Five houses, Henniker's Gardens. G. and I. Fox, builders, 2A, Latham Road, East Ham.

(PLAISTOW, E.).—Police station and men's quarters. J. Dixon Buller, New Scotland Yard, S.W.

(WHITECHAPEL, E.).—School in Buxton Street. T. J. Bailey, Education Architect, L.C.C. Offices, Victoria Embankment, W.C.

(WOOLWICH, S.E.).—Adaptation of building in Wickham Lane, for temporary accommodation of physically-defective children (£305); T. J. Hawkins & Co., contractors, Victoria Street, S.W. Police Station (£11,500); J. Dixon Buller, surveyor to Metropolitan Police, New Scotland Yard, S.W.

(NEW SOUTHGATE, N.).—Conversion of school, Garfied Road, into mixed department (£1,444). H. Knight & Son, builders, 16, Bruce Grove, Tottenham, N.

(ACTON GREEN, W.).—Proposed extension of Wesleyan Methodist chapel buildings, for the Trustees.

(HOLBORN, W.C.).—Rebuilding of property adjoining Dunstable Court. Secretary of Harpur Charity.

LONG EATON (DERBYSHIRE).—County schools with cookery and manual instruction departments. G. H. Widdows, architect, St. Mary's Gate, Derby.

LOSSIEMOUTH (MORAYSHIRE).—Proposed harbour extension. W. Barron, civil engineer, Aberdeen.

LUTON.—Free library; S. F. L. Fox, borough surveyor. School (£1,000); Brown & Sons, architects, 9, Castle Street, Luton. Pumping station; S. F. L. Fox, borough surveyor, Luton.

MALVERN.—Church and institute, Upper Colwall. A. H. Parker & Son architects, 5, Foregate Street, Worcester.

MANCHESTER.—Additional model lodging houses; City Surveyor. New library for the T.C. at Cheetham Hill Road (£8,000).

MANSFIELD.—Houses, Southwell Road, for the Somercotes Land Society; Chesterfield Road, for J. Lucas; Brownlow Road, for S. Clay.

MARGATE.—Re-building of shop premises (lit by electricity), Queen Street, for Bobby & Co., Ltd., drapers, &c.; two houses, St. Peter's Footpath, for W. L. Bennett.

MARKET DRAYTON.—Four houses, Bentley's Row, for the Oddfellows' Lodge.

MARYPORT.—Conversion of premises in Wood Street into Conservative Club.

MIDSOMER NORTON.—School (£8,000). Samson & Cottam, architects, Bank Buildings, Hammet Street, Taunton.

MILNROW (LANCS.).—Proposed new elementary school. Secretary, Rochdale Education Committee.

MITCHAM (SURREY).—Houses, Devonshire Road, for E. Larney; Boscombe Road, for G. S. Cook; Wandle Road, for H. M. Ellis; offices and residence, Grenfell Road, for Snelling & Gathercole; additions to schools, Lower Green, for the Managers of the Catholic Schools.

MORDEN.—New school (£5,830). R. Nares, secretary, Surrey Education Committee, Kingston.

NANTWICH.—Alterations, &c., at the Grammar School (£187). H. Beswick, architect, Chester.

NEATH (GLAM.).—Swimming baths. Mr. Jenkins, architect, Guildhall, Neath.

NELSON (LANCS.).—Prospective restoration, after fire, of the Scotland Road Primitive Methodist Church.

NEW BRIGHTON.—Semi-detached villas, in Vaughan Road, for John Owen.

NEWCASTLE-ON-TYNE.—New concert hall and business premises in Princess Street (seat 3,500). Graham & Hill, architects, Newcastle-on-Tyne.

NEWPORT (ISLE OF WIGHT).—Proposed new National Schools (£4,000). Rev. H. E. Sharp, vicar.

NORTHAMPTON.—Additions to hospital (£7,000). F. Dorman, architect, 5, Mercer's Row, Northampton.

NORTH SHIELDS.—Stores, offices, and conveniences on the Union Quay. J. F. Smillie, borough surveyor, Tynemouth.

NORTHWICH.—New school for Cheshire C.C. (£5,000).

OLDBURY.—School. Mr. Jackson, architect, Langley Green, Birmingham.

PAISLEY.—Six houses, Arkleston Road. J. Wilson, builder, Paisley.

PLYMOUTH.—Swimming and Turkish baths (£6,000). E. Coath Adams, architect, 20, Bedford Street, Plymouth.

PONTYPOOL.—New wing to Hospital. R. and S. Williams, architects, Borough Chambers, Wharton Street, Cardiff.

PORTSMOUTH.—Probable re-instatement, after fire, of business premises, 140, Commercial Road, Landport, for John Parkhouse; two houses, Shadwell Road, for W. Ford; house and dairy, Milton Road, for Gauntlett & Sons; houses, Powerscourt Road, for A. Chase; ice store, Brunswick Street, for the Portsmouth Ice and Cold Storage Co., Ltd.

PORT TALBOT (GLAM.).—Additions to laundry; T. Gibb, architect, 27, Station Road, Port Talbot. Twenty houses, Tonmawr (£4,000); F. B. Smith, architect, Station Road, Port Talbot.

PURLEY (SURREY).—Friends' Meeting House, Downes Court Road. Pepler and Allen, architects, 3, George Street, Croydon.

RADFORD (COVENTRY).—School (£8,000). G. Steane, architect, 22, Little Park Street, Coventry.

RHYL.—Proposed Convalescent Home for the London and North-Western Joint Railway Servants' Hospital Fund Committee. S. Lyon, secretary, Crewe.

RICHMOND-ON-THAMES.—Public convenience, for the T.C. Borough Surveyor.

ROCHESTER.—Restoration of St. Nicholas Church, and probable installation of the E.L. (£1,000). E. Farley Cobb, architect, 20, High Street, Rochester.

ROMNEY MARSH.—Additions and alterations to pumping station (£1,695). Fitch & Cox, builders, Baker Street, Enfield.

RUGBY.—Opera House. H. Percival, architect, 47, Mortimer Street, London, W.

ST. ALBANS.—Motor fire factory, London Road. E. Dunham, builder, 65, Victoria Street, St. Albans.

ST. GERMANS (CORNWALL).—Proposed new isolation hospital. Chairman, Joint Isolation Hospital Committee.

ST. HELENS.—Extension of schools for the Committee of Brook Street Congregational Church.

SCARBOROUGH.—New school in Filey Road, for the Corporation.

SHINFIELD (BERKS.).—School at Hyde End for the C.C. Education Secretary, The Forbury, Reading.

SLIGO (IRELAND).—Branch for Hibernian Bank. Manager, Head Office, Dame Street, Dublin.

SLOUGH.—Houses. King's Road, for A. Woolsey; Montague Road, for Hawkes and Barker.

SMETHWICK.—Seven houses, Uplands, for T. W. Evans; 17 houses, Bowden Road, for H. B. Bowden; shop, High Street, for the Misses Biddle.

SOUTHAMPTON.—Cemetery chapel and lodge; J. A. Crowther, engineer, Southampton Town Council. New store at rear of 2, St. Mary Street; Mitchell, Son & Gutteridge, architects, 9, Portland Street, Southampton. Two houses, Lumsden Road; Jurd and Sanders, architects, 23, Portland Street, Southampton.

SOUTHSEA.—Extensive alterations to business premises, Palmerston Road, for Flora, Ltd., 166-168, Sloane Street, London, S.W.

SOUTH SHIELDS.—New Public Hall in Denmark Street, for Thos. Alderson; G. R. Smith, architect, King Street, South Shields. Bank premises, corner of Stanhope Road and Boldon Lane, for North-Eastern Banking Co.; H. Chapman, jun., architect, 12, Grey Street, Newcastle-on-Tyne. New Public Hall in Derby Street, for Mrs. Jane Forster; J. Forster, builder, 85, Grange Road, Jarrow-on-Tyne.

STIRLING.—Houses, workshop, and stables for John McAllister, joiner, Kersemill; double villa, in Cecil Street, for E. Simpson, architect, 16, King Street, Stirling; villa in Alexandra Place, for William McPherson, joiner.

STOCKPORT.—Hotel, Broadstone Road, Reddish, for Clarke, Ltd., brewers, Stockport. D. Eadie, builder, Short Street, Stockport.

STOWMARKET.—School. J. Leighton, architect, Ipswich.

SURBITON.—Special Subjects building. R. Nares, Secretary to the Surrey Education Committee, Kingston.

SUTTON COLDFIELD.—New school in Green Lanes, for the T.C. (£2,600).

SWANAGE.—Business premises, High Street, for Parsons & Hayter.

SWANSEA.—Art Gallery (£12,000). G. Moxham, architect, Castle Street, Swansea.

TAUNTON.—Semi-detached villas; Mr. Rabjohns, builder. New swimming bath at Queen's College; H. J. Spiller, builder, Taunton. New residence at Bishop's Hall, for Mr. Gibbs; A. J. Spiller, builder, Taunton.

TODDINGTON (BEDFORDSHIRE).—School. Gotch & Saunders, architects, Bank Chambers, High Street, Kettering.

TOPSHAM (DEVON).—Wesleyan Memorial Hall (£2,000). F. Haswell, architect, 77, Tyne Street, South Shields; J. Tremlett, builder, Fore Street, Topsham.

UPTON-ON-SEVERN.—Diphtheria block at the Isolation Hospital for the B.G. (£1,170). J. & A. Brazier, builders, Worcester Road, Bromsgrove.

WALSALL.—Works for the East Anglian Cement Co., Cambridge. Henry Lovett, Ltd., builders, Darlington Street, Wolverhampton.

WATFORD.—New station for Euston and Watford Electric Railway; Brightman and Sons, builders, Watford. New office, &c., Market Street; W. King, builder, 41, Market Street, Watford.

WEALDSTONE.—New school for 600 scholars. H. T. Wakelam, surveyor to the Middlesex C.C., Guildhall, Westminster, S.W.

WELLINGTON (SOMERSET).—New shops, North Street. E. T. Howard, architect, The Ferns, Wellington. New engineering shop and classrooms at the County School; G. Corner, headmaster.

WEMBLEY.—Additions to school at Alperton (400 places), and new school at Blind Lane (600 places). H. T. Wakelam, surveyor to the Middlesex C.C., Guildhall, Westminster, S.W.

WHITBY.—Alterations and additions to the Seamen's Hospital premises. E. H. Smales, architect, 5, Flowergate, Whitby.

WIGAN.—New church, Millgate, for the Protestant Church Mission; two houses and shops, Park Road, for J. Wilson & Co., builders, Caroline Street; four houses, Northumberland Street, for T. and J. Pyke; three houses, Northumberland Street, for A. Sharples.

WINCHELSEA.—Houses for Ellis Bros., builders, Military Road, Rye; and S. Harvey, builder, Market Street, Rye.

WOLSTANTON.—Proposed central dining hall for the workhouse. Clerk to the Wolstanton Board of Guardians.

WOLVERHAMPTON.—Probable re-erection (after fire) of bakery, Whitmore Reans, for T. Jackson, Ltd., cake manufacturers.

WORKSOP.—Seven houses and shop, Sandy Lane, for White & Son.

WORSBRO' (near BARNSLEY).—Houses, The Walk, Birdwell, for W. Avill and J. J. Roebuck; Blackburn Row, Worsbro' Bridge, for W. Botham; Station Road, Worsbro' Dale, for J. and F. Hammerton; Baden Street, Worsbro' Dale, for J. Lunn.

YARDLEY.—New school for Worcestershire C.C. J. G. Dunn, architect, Newhall Street, Birmingham.

YARMOUTH.—New grammar school at North Denes. Olley & Haward, architects, Queen Street, Yarmouth.

YIEWSLEY (MIDDLESEX).—School, Providence Road (£4,928). W. J. Dickens, builder, Helena Chambers, Ealing.

YSTRADGYNLAIS (BRECONSHIRE).—School. J. C. Rees, architect, St. Thomas's Chambers, Neath (Glam.).

## FORTHCOMING EVENTS.

**Liverpool and District Electrical Association.**—Tuesday, January 5th. At 8 p.m. At the Common Hall, Hackins Hey, Liverpool. Paper on "Central Stations and Gas Engines," by Mr. A. Weatherilt.

**Royal Institution.**—January 5th, 7th and 9th. At 3 p.m. Lectures on "The Wheel of Life," by Prof. W. Stirling.

**Electrical Standardising, Testing and Training Institution.**—At the recent Scholarship Examinations held at Faraday House, Mr. W. B. Cushion, of Gresham's School, Holt, Norfolk, has been awarded an entrance exhibition of 25 guineas a year, tenable for three years.

## NOTES.

**Croydon Tramways Benefit Society.**—The annual general meeting of the Croydon Corporation Tramways Employés' Sick and Benefit Society, was held at midnight on Saturday, December 19th, at the Thornton Heath depôt, a special car being run to convey the employés from Purley depôt. Mr. T. B. Goodyer, A.I.E.E., tramway manager (president), was in the chair, and he was supported by Mr. H. B. Harris, engineer; Dr. F. C. Crapel, medical officer to the society; and by Mr. H. Smith, secretary. A large number of the members attended. The contributions to the society are based on a weekly payment of 1s. 1d., which entitles the members to sick pay allowances at the rate of 20s. per week for a period of 13 weeks, and also to free medical attendance. In reviewing the work of the society during the year, the president stated that the audited accounts showed the total contributions to have amounted to £400, a reduction of £72, compared with the preceding year, due, unfortunately, to the fact that the membership was smaller, the average for the year being 133, against 163 in 1907. The sick pay amounted to £92 10s., an increase of £7; and the amount refunded to members leaving, totalled £10 13s. 1d., an increase of £3 11s.; medical attendance amounted to £27 13s.; salaries to £7 14s.; printing to £2 8s.; and death grant, £6 13s. The average expenditure per member, for sick allowance, was 13s. 4d., whilst the full average expenditure per member amounted to £1 1s. 3d. for the year. The share out amounted to £1 18s. 2d., and although this was 3s. 8d. per member less than in the preceding year, due to the causes above mentioned, general satisfaction was expressed at the result of the year's working.

**Electric Shock Fatality.**—A Manchester young man named Thomson, employed by the British Westinghouse Co., was accidentally killed by electric shock on Thursday last week. He was working new machinery at Messrs. Barber & Walker's electric power station at Moor Green, near Nottingham, when he came into contact with a live wire. Medical assistance was at once obtained, and everything possible done, but he never regained consciousness, and died within an hour. Deceased was a married man with a family.

**P. & O. Batti-Wallahs.**—The Birmingham Local Section of the P. & O. Batti-Wallahs' Society, which was formed about five or six months ago, has now a membership of 65. Following upon its two smoking concerts, the Section on Thursday, December 17th, entertained quite a number of friends, including ladies, at a Bohemian Concert at the Grand Hotel in the Grosvenor Room, which was well filled, over 160 being present. The programme was a most enjoyable one.

**Regulation of Arc Lamps.**—In a lengthy article recently concluded in the *Elektrotechnische Zeitschrift*, the author, Mr. J. Teichmüller, gives the results of protracted experiments on arc lamps with inclined carbons and blowing magnets, and combats the theory that the arc is repelled by the field of the magnet; not only is the usefulness of the alleged action attacked but also the principle itself, and a different explanation of the beneficial action of the magnetic field is given.

**Copper Mine Hydro-Electric Plant.**—At a meeting of the Consolidated African Copper Trust, held in London last week, the chairman, Dr. Hans Sauer, said that the Edmundian Co. had, in conjunction with Mr. A. L. Lawley, formed an electrical power company, which was generating electricity by means of water-power obtained from the Revue River. A hydro-electric generating plant, capable of producing 400 H.P., had been installed, and was running satisfactorily. It was estimated that a saving of about £3,000 to £4,000 annually in working costs would be effected by the Edmundian Co. by the use of electric power.

**Organ Blowing by Electrical Fans.**—A well-known German engineer, Dr. J. Kollmann, of Bad Ems, has communicated to the *Frankfurter Zeitung* particulars of a new application of electricity to organ and harmonium blowing, which he describes as being both cheaper and neater than the hydraulic apparatus hitherto used to supersede hand labour, and also superior to the electric contrivances in use during the last 10 years, in which a motor communicates the required up-and-down movement to a bellows by means of a large eccentric driving wheel. His invention consists of an electrically-driven fan, which supplies the wind directly to the organ pipes without the intervention of a bellows, requiring no more current than a 25-C.P. incandescent lamp. The wind supply from the electric fan is far more equable than that from any other source of power.

**Institution and Lecture Notes.**—INSTITUTION OF CIVIL ENGINEERS: STUDENTS' MEETING.—At the students' meeting held on Friday, December 18th, at 8 p.m., Mr. E. P. Hill, M.Inst.C.E., in the chair, the paper read was "High-Power Water Turbines on Moderate Falls," by R. Woldenden, M.Sc., Stud. Inst.C.E. The paper, which was illustrated by lantern-slides, described briefly the various types of impulse and reaction turbines and their regulation, and discussed mathematically the design of mixed flow and radial inward flow turbines. In the subsequent discussion the following gentlemen took part:—Messrs. A. Caldwell-Smith, C. J. Guttmann, D. G. French, G. Lacey, G. Lovegrove, A. S. Quartermaine, D. H. Thomson, F. W. Cockshott and R. C. Wells. The chairman, in summing up, referred to the benefit derived by turbine-users from the construction of reservoirs for water supply.

DUNDEE INSTITUTE OF ENGINEERS.—"Electrical Energy; its Transmission and Distribution," was the subject of a lecture by Prof. Magnus Maclean, of the Glasgow and West of Scotland Technical College, to the members of the Dundee Institute of Engineers at a recent meeting. He described the operations of the Scottish electrical power companies, and referred to coming developments. On the motion of Mr. Harry Richardson, the Corporation electrical engineer, the lecturer was thanked.

INSTITUTION OF MUNICIPAL ENGINEERS.—The roll of the Institution is now: Members, 412; Students, 15.

At a Council meeting on December 16th, it was resolved that all future applications for membership must be signed by a proposer and seconder, who are either members of the Institution of Municipal Engineers or of some other well-known engineering institution. On the unanimous vote of the members present, Mr. John T. Pegge, city engineer and surveyor of Durham, was elected President of the Institution for the year ending June 30th, 1909.

A general meeting of the Institution will be held at Caxton Hall, Westminster, on Saturday, January 16th, 1909, when the presidential address will be read. Amongst other papers which will be discussed is one on "Street Lighting in the Smaller Urban Districts," by E. F. Willson, surveyor to the Epping Urban District Council. A conversazione will afterwards be held, with a reception by the president.

LEEDS ASSOCIATION OF ENGINEERS.—The annual report shows that the Association is in a satisfactory position, having a balance of £111, besides various funds for special purposes.

**Evading the Patents Act.**—An ingenious suggestion for driving a coach and four through the Patents Act (says the *Standard*), is mentioned by Mr. J. N. McCunn, United States Consul at Glasgow, in a report to the Bureau of Manufactures at Washington. Referring to qualifying words in the Act in reference to the working of a patent to an adequate extent in this country, Mr. McCunn says:—

"I am informed that it would appear to be perfectly in order to manufacture the parts of a machine in the United States and have them assembled in the United Kingdom. The ground on which this view is taken is that each part of the machine, taken separately, is not a patented article, the patent merely applying to the machine as a whole. No test case has yet been taken in the British courts, and I am informed that the above is the generally accepted reading of the law until such a test case is brought."

It may be assumed, remarks our contemporary, that if the suggestion above referred to is acted upon, very little time will be lost in testing the legality of such method of evasion, and, if necessary, amending the Act.

**Smoke Nuisance.**—Last week the County of London Electric Supply Co., Ltd., were fined 20s. for not having put an end to smoke nuisance at their Wandsworth generating station. It was stated for the company that it had expended some £2,000 upon smoke prevention appliances, but occasional smoking was unavoidable.

**Appointment Vacant.**—Switchboard attendant for Kirkcaldy (25s.).

**Will.**—The late Mr. R. N. Reid, of Reid Bros., telegraph engineers, &c., Wharf Road, N., left an estate of £58,250 gross, with net personalty of £58,113.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**—MR. P. R. BLAKE, lately shift engineer at the Birmingham and Midland Tramways Power Station, Smethwick, was, on 20th inst., presented with a handsome silver watch by the resident engineer, Mr. S. A. Mahood, on behalf of the staff. Mr. Blake has recently been appointed resident engineer at the City of Birmingham Tramways Co.'s Power Station at Bournbrook, Birmingham.

Dover T.C. has granted a gratuity of £10 to MR. MARTIN, E.L. canvasser, and has fixed his salary for the coming year at £110 and 4d. per lamp for all lamps ordered during that period beyond 1,800. This is owing to his commission having been adversely affected by the advent of the new metallic-filament lamps.

**General.**—The *Times* says that MR. EDGAR ALLEN, who gave £10,000 for the establishment of the Sheffield University Library, now in course of completion, has contributed over 400 volumes from the library of the late Mr. Marsden, of Sheffield.

After having been 20 years in the electrical profession, which he entered as a pupil in 1889, MR. ROLAND H. SIBBATFIELD was ordained on Sunday, December 20th, at Rochester, by the Bishop of Rochester, and has now started his new duties as an assistant curate at St. James's Church, Tunbridge Wells. After a very wide and varied experience in power station equipment and running, tramway and railway work, &c., Mr Streatfield left the B.T.-H. Co. last year to pursue his theological studies. He is a M.I.E.E. and an A.M.Inst.C.E.

MR. J. BALFOUR ROBERTSON, late of Messrs. J. H. Holmes & Co., Newcastle-on Tyne, has been appointed sole manager and representative for Messrs. Lowdon Bros. & Co. at their Edinburgh branch, 50, Frederick Street.

It is reported in the *Times* that MR. GEORGE WHALE, who five years ago followed the late Mr. F. W. Webb as chief mechanical engineer of the L. and N.W. Railway, has resigned that office because of ill-health.

**Obituary.**—We regret having to record the death of DR. GEORGE GORE, F.R.S., LL.D., which occurred at Birmingham, on December 23rd. Dr. Gore was 82 years of age, and he was a veteran in physical and chemical science. He was during his lifetime a voluminous contributor to the *Proceedings* of the Royal Society and other scientific institutions on electrochemical and electrometallurgical matters, a great variety of experimental researches pursued by himself being the subjects of these communications. Like many other men of science, he had failed to make money by his work, and in 1891 a Civil List Pension was granted in recognition of the value of his discoveries to the nation.

SIR P. A. MUNTZ, M.P., chairman of Muntz's Metal Co., died on December 21st, at Dunsmore, near Rugby.

## NEW COMPANIES REGISTERED.

**Guaranteed Public Works Co., Ltd.** (100,829).—This company was registered on December 23rd, with a capital of £1,000 in £1 shares, to seek and obtain contracts, orders or concessions for railways, harbours, canals, tramways, means of transport, sewers, buildings, electric lighting, power and general engineering works and construction in any part of the world having Government, municipal or other guarantees or prospects of profit or other revenue, or at the discretion of the directors to engage in any business, with or without guarentees, which appears likely to be profitable. The subscribers (with one share each) are:—J. S. Porter, 169, Hampstead Road, N.W., merchant; A. W. Hill, 35, Craven Street, W.C., financial agent; Miss M. B. Stiles, 2, Malfort Road, Denmark Hill, S.E., typist; E. G. Van Tromp, 16, Essex Street, W.C., solicitor; F. E. Spencer, 36, Carter Street, Kennington, S.E., clerk; D. W. Spooner, 12, Ritchings Avenue, Walthamstow, clerk; W. J. Williams, 169, Waldegrave Road, Teddington, cycle agent. Minimum cash subscription, £7. "On a show of hands, only ordinary shareholders shall vote, and only the holding of 100 ordinary shares shall entitle the holder to one vote." (All the original shares appear to be ordinary.) Voting powers at poll not specified. The number of directors is not to be less than two or more than nine; the first are J. S. Porter and E. G. Van Tromp; qualification, one ordinary share; remuneration (except managing director), £100 each per annum, and 10 per cent. of the net profits up to £2,000 a year, divisible. Registered office, 16, Essex Street, Strand, W.C.

**Wallach Bros., Ltd.** (100,842).—This company was registered on December 23rd, with a capital of £15,000 in £1 shares (5,000 preference), to take over the business carried on by J. Wallach and L. C. Wallach as "Wallach Bros.," and to carry on the business of asbestos and rubber manufacturers and dealers, engineers, mill furnishers, chemical merchants, machinery dealers, manufacturers and contractors, dealers in proprietary articles and electrical, chemical, scientific and photographic apparatus and materials, &c. The subscribers (with one share each) are:—W. E. Brighten, 108, Fenchurch Street, E.C., solicitor; A. W. Lemon, 108, Fenchurch Street, E.C., solicitor; J. Wallach, Royal London House, E.C., merchant; J. C. Wallach, Royal London House, E.C., merchant; E. J. Stannard, 19, Eastcheap, E.C., solicitor; A. E. Green, 17, Coleman Street, E.C., incorporated accountant; G. C. Bosanquet, 19, Eastcheap, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the governing directors are J. Wallach and L. C. Wallach, each of whom may retain office while holding one-third of the issued shares. Registered by Robinson, Stannard & Bosanquet, 19, Eastcheap, E.C.

**A. L. M. Synd., Ltd.** (100,822).—This company was registered on December 23rd, with a capital of £100 in 1s. shares, to acquire and dispose of the English and German patents in connection with the process for the manufacture of flexible aluminium foil, with a view thereto to take over the benefit of two contracts (1) dated November 4th, 1908, and made between Aluminiumfabrik Gontenschweil A.G. of the one part, and A. J. Faulding of the other part, and (2) dated November 3rd, 1908, and made between A. J. Faulding and others of the one part, and the Aluminium Corporation, Ltd., of the other part, and to carry on the business of aluminium foil manufacturers, &c. The subscribers (with one share each) are:—A. J. Faulding, 18 Blomfield Road, Maida Vale, W., director; J. W. Sidley, 115, Fore Street, E.C., manufacturer's agent; R. C. Sidley, 115, Fore Street, E.C., manufacturer's agent; T. Crawley, 115, Fore Street, E.C., manufacturer's agent; J. W. Gates, 115, Fore Street, E.C., manufacturer's agent. Private company: The number of directors is not to be less than three or more than 10; the first are A. J. Faulding, J. W. Sidley and J. Leemann-Abderhalden. Registered by A. O. Warren, 2, Broad Street Place, E.C.

**Dennison, Kett & Co., Ltd.** (100,769).—This company was registered on December 19th, with a capital of £3,000 in £1 shares, to carry on the business of mechanical and electrical engineers and contractors carried on at 11, Queen Victoria Street, E.C., and 61-3, Lant Street, S.E., as Dennison, Kett and Co. The subscribers (with one share each) are:—E. W. Dennison, Fairmead, Grove Park, Kent; F. Stur, 62, Sandrock Road, Lewisham, S.E., engineer; F. S. Stephens, 49, Queen Victoria Street, E.C., incorporated accountant; G. Kett, 108, Gordon Road, Peckham Rye, S.E., engineer; H. G. Stimson, 10, Moorgate Street, E.C., solicitor. Private company. The number of directors is not to be less than two or more than five: E. W. Dennison is one of the first, and may retain office while holding £100 shares. Registered office, 11, Queen Victoria Street, E.C.

**Thomas Transmission, Ltd.** (100,646).—This company was registered on December 11th, with a capital of £5,000 in £1 shares, to acquire from J. G. P. Thomas a British patent relating to an electro-mechanical power transmission system, to turn the same to account, and to carry on the business of manufacturers of and dealers in motor-cars and vehicles, electrical and mechanical engineers, &c. The subscribers (with one share each) are:—W. A. Tritton, 48, Anson Road, N., engineer; H. J. Thomson, 121, West Parade, Lincoln, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are W. A. Tritton, H. J. Thomson and A. R. Mitchell, of 3, Balfour Road, Walmer, Kent. Registered office, Monson Chambers, Corporation Street, Lincoln.

**Beaten Metal Co., Ltd.** (100,845).—This company was registered on December 24th, with a capital of £2,000 in £1 shares (500 preference), to take over the business of manufacturers of arc metal work and gas and electric light fittings, &c., carried on at 90, Bromsgrove Street, Birmingham, as the Beaten Metal Co., and to adopt an agreement with C. A. Cooke and W. G. Galley. The subscribers (with one share each) are:—W. G. Galley, 64, Oakfield Road, Balsall Heath, Birmingham, managing clerk; C. A. Cooke, 54, Blenheim Road, Moseley, Birmingham, manufacturer. Private company; the number of directors is not to be less than two or more than five; the first are C. A. Cooke and W. G. Galley; qualification, 100 shares. Registered office, 90, Bromsgrove Street, Birmingham.

## NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

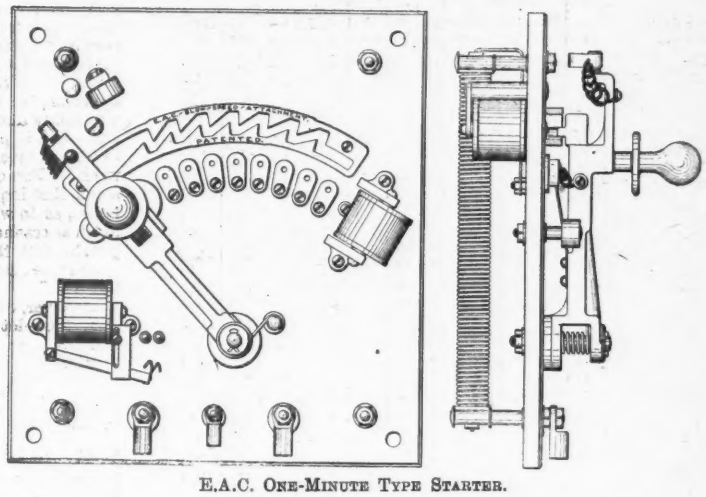
### E.A.C. One-Minute Type Starter.

The ELECTRICAL APPARATUS CO., LTD., have brought out a new one-minute starter, with slow motion attachment. From the illustration, it will be seen that the slow motion is attained by the alternate camming and arresting by the zig-zag groove of the pawl carried in the starter lever.

The operation is as follows: The pawl is normally held against the bottom side of the groove. In moving the lever forward the pawl encounters the first lower tooth, and is cammed upwards until it strikes the first arresting tooth, which prevents further progress until the forward pressure is released, when the pawl is pulled down the slot and thus allows the operation to be repeated on the subsequent teeth. In coming off, the pawl is free to rise over the teeth, and does not impede the motion of the lever.

The principal differences between this device and existing apparatus for producing a slow acceleration are: (1) Extreme simplicity; (2) Practically all other appliances of a similar character produce a uniform slow motion. This is undesirable in view of the protracted arcing which necessarily takes place in passing from one segment to another.

The E.A.C. device allows a rapid forward motion and only arrests the movement when the contact brush is "full-on" the particular segment. The resistances are rated to carry 50 per cent. overload and to allow 60 seconds in cutting out resistance.



E.A.C. ONE-MINUTE TYPE STARTER.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Rhondda Tramways Electric Supply Co., Ltd.** (94,470).—Issue on November 23rd of £15,000 debentures, part of a series to secure £44,000, particulars of which have already been filed.

**Venezuela Telephone and Electrical Appliances Co., Ltd.** (31,305).—This company's annual return was filed on December 18th, when 70,000 ordinary and 860 preference shares had been taken up out of a nominal capital of £85,000 in 70,000 ordinary shares of £1 each and 1,500 preference shares of £10 each. £1 per share has been called up on 13,494 ordinary and £10 per share on 860 preference shares, resulting in the receipt of £22,094. £65,506 is considered as paid on 56,506 ordinary. Mortgages and charges: £88,500.

Particulars of £39,000 prior lien debentures created by resolution of December 1st, and secured by a trust deed dated December 7th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. The above-mentioned trust deed has also been registered. Property charged: Various telephone systems in Venezuela, the contract or concession granted by the Venezuelan Government, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Premier Investment Co., Ltd.

**Lancashire Power Construction Co., Ltd.** (77,202).—Trust deed dated November 26th, 1908, to secure £150,000 5 per cent. first mortgage debenture stock, with power to create a further issue of stock for a like amount. Property charged: £90,000 debenture stock and 27,002 £10 fully paid shares in the Lancashire Electric Power Co. (Parliamentary company) and any other stock, debentures, or shares, to which the company may become entitled, and the company's undertaking and property, present and future, including uncalled capital. Trustees; S. C. Bouiter, 41, Threadneedle Street, E.C.; and N. Spens, 12 and 13, Nicholas Lane, E.C.

**Suffolk Electricity Supply Co., Ltd.** (58,665).—Particulars of debentures to secure not more than half the paid up capital for the time being, created November 2nd, 1898, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £50. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Dick, Kerr & Co., Ltd.** (63,467).—This company's annual return was filed on October 15th, when 305,000 preference and 260,000 ordinary shares had been taken up out of a nominal capital of £650,000 in £1 shares (350,000 preference and 300,000 ordinary). £265,000 has been paid on 265,000 preference and £300,000 is considered as paid on 40,000 preference and 260,000 ordinary. Mortgages and charges: £271,030.

## CITY NOTES.

**Halifax and Bermudas Cable Co., Ltd.**—The directors have declared an interim dividend of 5 per cent. per annum (2s. 6d. per share) for the past half-year.

**Aluminium Corporation, Ltd.**—A meeting of creditors was held at Winchester House, E.C., on Dec. 23rd, Mr. L. Whittem Hawkins, a joint liquidator, presiding. After a lengthy statement by the chairman, the meeting was adjourned for four weeks to enable the liquidators to prepare a definite scheme. The petitioning creditors agreed to defer their petition until a week thereafter.

**Anglo-Argentine Tramways Co., Ltd.**—At an extraordinary general meeting held on December 18th, in London, a number of resolutions for re-arrangement of capital were passed

**American Telegraph and Telephone Co.**—For 11 months of this year the net receipts of this company, after payment of interest, were $18,060,000, compared with $14,820,000 for the same period last year, while the balance after payment of dividends was $8,771,000, against $6,927,000 in 1907.

**Stock Exchange Notices.**—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

La Capital Traction and Electricity Co. (Buenos Ayres), Ltd.—£409,700 5 per cent. debentures (registered).

Rangoon Electric Tramway and Supply Co., Ltd.—Further issue of 10,000 6 per cent. cumulative preference shares of £5 each, fully paid, Nos. 40,001 to 50,000.

Sao Paulo Tramway, Light and Power Co., Ltd.—8,000 additional shares of $100 each.

Singapore Electric Tramways, Ltd.—£350,000 5 per cent. debentures of £100 each, Nos. 1 to 3,500.

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Sao Paulo Tramway, Light and Power Co., Ltd.—8,000 additional shares of $100 each.

Sumatra Para Rubber Plantations, Ltd.—Further issue of 15,000 shares of £1 each, fully paid, Nos. 70,000 to 85,000.

**Direct West India Cable Co.**—The directors have declared an interim dividend of 6 per cent. per annum (1s. 6d. per share), for the past half-year.

**Underground Electric Railways Co. of London.**—Sir Edgar Speyer presided at this company's annual meeting on 21st ult., when the report, already published (see ELECTRICAL REVIEW, December 18th, 1908), was adopted. In February the balance-sheet to December 31st will be submitted to shareholders.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended November 27th, 1908, was 358,911, compared with 314,207 units in the corresponding four weeks of 1907.

**Liverpool Electric Cable Company, Ltd.**—At the seventh ordinary general meeting, held in Liverpool on December 22nd, there was declared a dividend of 5 per cent., making, with the interim dividend of 2½ per cent paid in June, a total dividend of 7½ per cent., and a further bonus of 2½ per cent., making 10 per cent. for the year.

**Electric Conversion Syndicate.**—According to the *Financier*, the report states that during the 12 months ended September 30th, the board has been principally engaged in liquidating the amounts due to secured creditors, the amount of whose debts were at above date £7,642. Since the closing of the books, this amount has been further reduced.

**Melbourne Tramway and Omnibus Co.**—A dividend of 4½d. per share for the quarter ending December 31st, equal to 15 per cent. per annum, has been declared.

**Barbados Telephone Co.**—The profit and loss account during the past half-year showed a credit balance of $3,778 34, which, after setting aside certain sums, enabled the directors to recommend the payment of a dividend at the rate of 4 per cent. for the half-year, absorbing $2,982.21, and to place to deposit account on account of the reserve fund $790.—*Barbados Agricultural Reporter.*

**Correction.**—In our Stocks and Shares letter last week by a slip of the pen we stated that the South London Electric Supply Corporation was offering *one million* pounds debenture stock. This was of course an error for *one hundred thousand* pounds.

**Italy.**—La Società Livornese di Trazione Elettrica, of Leghorn, is increasing its capital from £11,000 to £20,000.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

| Locality. | Fortnight ended. | Receipts for the fortnight. £ | Receipts for the fortnight. £* | No. of wks. | Total to date. £ | Total to date. £* | Route miles open. | Inc. |
|---|---|---|---|---|---|---|---|---|
| Aberdeen | Dec. 23 | 2,544 | + 80 | 30 | 42,896 | — 65 | 14·4 | .. |
| Ayr | ,, 26 | 360 | — 13 | 32 | 10,464 | — 259 | 8 | .. |
| Bath | ,, 23 | 1,341 | + 156 | 51 | 37,649 | — 2,090 | 13 | .. |
| Belfast | ,, 25 | 8,006 | + 76 | 39 | 142,509 | — 701 | 37 | .. |
| Birkenhead | ,, 27 | 2,182 | — 29 | 39 | 41,801 | + 878 | 13·52 | .. |
| Birmingham Corp. | ,, 19 | 13,242 | + 29 | 38 | 241,628 | + 6,929 | 56·46 | .. |
| Blackpool-Fleetw'd | ,, 26 | 522 | — 65 | 25 | 21,470 | — 1,635 | 8·25 | .. |
| Bolton | ,, 27 | 4,468 | + 178 | 39 | 90,393 | + 1,412 | 26 | .. |
| Bournemouth | ,, 23 | 2,778 | — 134 | 38 | 64,240 | — 3,266 | 21·78 | .. |
| Bradford | ,, 19 | 8,720 | — 6 | 37 | 177,207 | — 98 | 54·9 | .. |
| Brighton | ,, 27 | 1,570 | — 29 | 38 | 36,781 | + 805 | 9·5 | .. |
| Bristol | ,, 25 | 10,693 | — 87 | .. | .. | .. | 31 | .. |
| Brit. Elec. Trac. Co. | | | | | | | | |
| Airdrie | Dec. 18 | 418 | — 34 | 50 | 11,184 | — 98 | 3·65 | .. |
| Barnsley | ,, 18 | 328 | — 5 | ,, | 8,860 | + 429 | .. | .. |
| Barrow | ,, 18 | 406 | — 48 | ,, | 12,203 | — 679 | 5·37 | .. |
| Cavehill | ,, 18 | 104 | — 4 | ,, | 4,329 | + 15½ | .. | .. |
| Devonport | ,, 18 | 949 | + 59 | ,, | 23,444 | + 447 | 8·85 | .. |
| Gateshead | ,, 18 | 1,956 | — 85 | ,, | 50,687 | — 45 | 11·25 | .. |
| Gravesend | ,, 18 | 355 | — 64 | ,, | 10,513 | — 1,746 | 6·5 | .. |
| Greenock | ,, 18 | 891 | — 111 | ,, | 26,238 | — 6,263 | 7·25 | .. |
| Hartlepool | ,, 18 | 398 | — 82 | ,, | 11,903 | — 2,551 | 6·72 | .. |
| Kidderminster | ,, 18 | 164 | — 20 | ,, | 5,508 | — 441 | .. | .. |
| Leamington | ,, 18 | 269 | + 7 | ,, | 8,620 | + 541 | 3 | .. |
| Merthyr | ,, 18 | 425 | .. | ,, | 10,684 | + 43 | 2·9 | .. |
| Metropolitan | ,, 18 | 10,764 | +1,537 | ,, | 288,983 | +53,789 | 22 | .. |
| Middleton | ,, 18 | 592 | — 36 | ,, | 17,688 | + 17 | 8·5 | .. |
| Mid. Joint Com'tee | ,, 18 | 11,073 | — 426 | ,, | 288,211 | — 6,909 | .. | .. |
| Oldham—Ashton | ,, 18 | 1,044 | — 48 | ,, | 29,366 | — 890 | 9·13 | .. |
| Peterborough | ,, 18 | 194 | — 23 | ,, | 6,844 | — 51 | 5·31 | .. |
| Potteries | ,, 18 | 3 586 | — 320 | ,, | 91,015 | — 2,972 | 29 | .. |
| Rothesay | ,, 18 | 71 | — 2 | ,, | 9,833 | — 505 | 2·75 | .. |
| Southport | ,, 18 | 412 | + 26 | ,, | 14,012 | — 739 | 8·17 | .. |
| S. Metropolitan | ,, 18 | 1,358 | .. | ,, | 40,511 | + 456 | .. | .. |
| Swansea | ,, 18 | 1,746 | + 49 | ,, | 47,388 | + 1,121 | 12·5 | .. |
| Tynemouth | ,, 18 | 261 | — 16 | ,, | 11,134 | — 800 | 3·75 | .. |
| Weston-s-Mare | ,, 16 | 52 | — 2 | ,, | 6,773 | — 108 | 3 | .. |
| ‡Worcester | ,, 18 | 488 | + 1 | ,, | 14,068 | — 91 | 5·75 | .. |
| Wrexham | ,, 18 | 182 | + 2 | ,, | 5,136 | — 2 | .. | .. |
| Yorks. Wool. Dist. | ,, 18 | 1,649 | — 26 | ,, | 45,794 | — 879 | 17 | .. |
| Miscellaneous | ,, 18 | 368 | — 27 | ,, | 10,398 | — 782 | .. | .. |
| Burnley | Dec. 26 | 2,469 | — 169 | .. | .. | .. | 7·5 | .. |
| Burton-on-Trent | ,, 27 | 518 | — 21 | 30 | 10,578 | — 644 | 10 | .. |
| Bury | ,, 27 | 2,175 | + 56 | 28½ | 45,465 | + 1,758 | 22·5 | .. |
| Cardiff | ,, 19 | 4,158 | + 28 | 38 | 82,437 | — 79 | .. | .. |
| Carlisle | ,, 26 | 345 | — 20 | 52 | 9,056 | — 33 | .. | .. |
| †Chatham and Dist. | ,, 17 | 761 | + 111 | 50 | 39,418 | + 3,012 | 14·98 | 2·82 |
| Cork | ,, 24 | 970 | + 37 | 51 | 23,642 | — 324 | 9·89 | .. |
| †Croydon | ,, 18 | 1,334 | — 37 | 38 | 53,773 | — 595 | 11·25 | ·75 |
| †Darlington | ,, 19 | 185 | — 29 | 38 | 7,511 | — 623 | .. | .. |
| †Darwen | ,, 25 | 516 | — 4 | 38 | 9,732 | — 293 | 4·36 | .. |
| Dover | ,, 19 | 318 | — 29 | 38 | 8,488 | — 386 | 4·75 | .. |
| Dublin | ,, 25 | 10,740 | + 109 | .. | 138,446 | —28,228 | 54·25 | 5·5 |
| Dundee | ,, 23 | 2,293 | — 16 | 31½ | 38,368 | + 1,839 | 14·5 | .. |
| East Ham | ,, 26 | 1,887 | — 7 | 39 | 31,415 | — 1,029 | 8·43 | ·68 |
| †Exeter | ,, 18 | 472 | + 12 | 38 | 12,139 | + 119 | 5·5 | .. |
| Glasgow | ,, 26 | 33,555 | — 878 | .. | 514,340 | — 9,674 | 90·5 | 1·5 |
| Hastings | ,, 24 | 1,594 | — 133 | .. | .. | .. | .. | .. |
| †Huddersfield | ,, 26 | 3,029 | — 81 | 39 | 62,178 | — 618 | 28·5 | ·5 |
| Hull | ,, 26 | 5,338 | — 40 | 39 | 95,173 | — 521 | 18 | .. |
| Ilkeston | ,, 23 | 247 | — 3 | 38 | 5,413 | — 73 | 3·5 | .. |
| Ipswich | ,, 26 | 739 | + 32 | 39 | 15,578 | — 343 | 10·5 | .. |
| Kilmarnock | ,, 19 | 289 | — 3 | 31 | 4,788 | — 268 | 4·26 | .. |
| Lan'kshire Trm Co. | ,, 24 | 2 351 | — 79 | 51 | 65,553 | + 2,922 | 17 | 1·18 |
| Lancashire United | ,, 23 | 2,285 | — 119 | 51 | 66.323 | + 2,363 | 39 | 1 |
| Leeds | ,, 19 | 12,576 | — 146 | 35 | 250,811 | + 3,531 | 96·75 | ·25 |
| Leicester | ,, 26 | 4,498 | — 114 | .. | .. | .. | .. | .. |
| Leith | ,, 19 | 933 | + 17 | 31½ | 16,692 | + 7 | 6 | .. |
| Liverpool | ,, 12 | 20,814 | — 321 | 50 | 533,137 | —10,624 | 104 | .. |
| ‡L.C.C. | ,, 12 | 67,575 | +7,220 | .. | 1,294,692 | —145,680 | 121¼ | .. |
| London United | ,, 26 | 11,245 | — 920 | .. | 337,460 | + 2,522 | .. | .. |
| Lowestoft | ,, 26 | 312 | — 25 | 13 | 2,095 | — 125 | 3·5 | .. |
| Manchester | ,, 26 | 29,935 | + 578 | 39 | 590,194 | +14,412 | 90·5 | 6 |
| Newcastle | ,, 26 | 8,337 | — 40 | 39 | 152,273 | — 8,237 | .. | .. |
| Newport | ,, 19 | 1,206 | — 37 | 38 | 25,137 | — 1,180 | 14·5 | .. |
| Oldham | ,, 27 | 3,939 | — 117 | 40 | 77,370 | — 587 | 23·75 | .. |
| †Pontypridd | ,, 12 | 367 | + 96 | 37 | 14,150 | + 4,185 | 5·5 | 1·75 |
| †Portsmouth | ,, 19 | 1,646 | — 14 | 38 | 77,581 | — 796 | 14·5 | .. |
| Preston | ,, 23 | 1,410 | — 82 | .. | .. | .. | .. | .. |
| †Reading | ,, 17 | 586 | — 14 | 37 | 23,428 | — 23 | 13·25 | .. |
| Rotherham | ,, 24 | 1,263 | — 76 | 38½ | 23,672 | — 36 | 10 | ·66 |
| †Salford | ,, 21 | 4,422 | — 116 | 28 | 177,731 | + 570 | 41 | .. |
| †Sheffield | ,, 20 | 5 510 | — 160 | 38½ | 214,573 | — 8,097 | 37 | 1·25 |
| Southampton | ,, 23 | 2,092 | + 103 | 38 | 41,641 | + 1,551 | .. | .. |
| †Southend-on-Sea | ,, 16 | 295 | + 33 | 38 | 17,660 | + 1,661 | .. | .. |
| South Shields | ,, 26 | 1,128 | + 8 | 39 | 21,981 | — 356 | .. | .. |
| †Swindon | ,, 9 | 114 | — 87 | .. | .. | .. | 4·4 | .. |
| Tyneside | ,, 23 | 784 | — 25 | 25 | 10,456 | — 940 | 8·87 | .. |
| Wallasey | ,, 26 | 1,654 | + 109 | 38½ | 35,086 | + 1,908 | 3·72 | ·22 |
| Walthamstow | ,, 26 | 1,169 | + 7 | 39 | 25,144 | + 1,230 | 9 | .. |
| West Ham | ,, 17 | 4,326 | — 119 | 38 | 84,223 | — 3,972 | 15 | ·3 |
| †Wolverhampton | ,, 16 | 779 | — 9 | 37 | 31,327 | — 766 | 12·5 | .. |
| Baker St.-Waterloo | Dec. 26 | 6,400 | + 490 | 26 | 79,580 | +13,565 | 4·25 | 1 |
| Cen. London Rly. | ,, 26 | 10,719 | — 589 | 26 | 182,685 | +44,830 | 6·32 | ·55 |
| Char. ✝, Exs. Hamp. | ,, 26 | 7,360 | +1,140 | 26 | 88,160 | +18,415 | 7·75 | .. |
| City & S. Lon. Rly. | ,, 27 | 6,492 | — 895 | 26 | 79,514 | — 2,831 | 7·3 | 1·06 |
| Dublin-Lucan Rly. | ,, 25 | 270 | + 36 | 25 | 3,551 | + 128 | 7 | .. |
| G.N. and City Rly. | ,, 26 | 3,921 | — 654 | 26 | 35,286 | — 8,799 | 3·5 | .. |
| G.N., P'dy. & Brmtn. | ,, 26 | 11,000 | — 710 | 26 | 135,015 | +21,705 | 9·25 | ·25 |
| †L'pool Overh'd Rly. | ,, 27 | 2,588 | — 69 | 26 | 35,950 | — 5,801 | 6·8 | 4·3 |
| Mersey Railway | ,, 26 | 4,192 | — 37 | 26 | 49,528 | + 1,160 | 4·5 | .. |
| Metropolitan Rly. | ,, 27 | 34,406 | +1,171 | .. | 426,985 | +24,809 | 24·5 | .. |
| Met. District Rly. | ,, 26 | 19,539 | +2,389 | 26 | 244,221 | +37,509 | 24 | .. |
| †Anglo-Argentine | ,, 16 | 27,604 | +8,694 | .. | 1,085,879 | +240,380 | 43 | .. |
| §Auckland | ,, 4 | 13,524 | +1,7367 | 48½ | 149,870 | +23,519 | 22·3 | 3·1 |
| Bombay (B.E.T.) | ,, 8 | 5,354 | + 444 | 47 | 116,632 | +19,636 | .. | .. |
| §Brisbane | ,, 30 | 14,504 | + 934 | .. | .. | .. | .. | .. |
| Calcutta | ,, 26 | 6,938 | + 270 | .. | .. | .. | .. | .. |
| §Kalgoorlie, W.A. | Nov. | 2,771 | .. | 48 | 42,967 | .. | 20·5 | .. |
| Madras | Dec. 15 | 1.197 | — 39 | .. | 28,219 | + 1,188 | 12·75 | .. |
| Perth (W.A.) | ,, 25 | 3,309 | — 110 | 52 | 71,694 | — 1,308 | 25·6 | .. |

* Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

## STOCKS AND SHARES.

Tuesday Afternoon.

WITH the usual reaction after Christmas still pervading the world of commerce, and with no particular business doing in the Stock Exchange, the annual retrospective glance concludes the year appropriately, and with no displacement of matters more important. For electricity companies of all kinds—railway, supply, traction, telegraph, and, to a smaller extent, manufacturing—the year now ending has been marked by developments which now and again threatened to become exciting. Space does not allow of incursions into the past of fact when the history of prices demands attention, but the movements in the accompanying sets of statistics are mainly due to causes which will be readily recollected by those interested in particular securities where alterations have occurred, as well as by others who courteously follow these columns week by week. The open confession so good for the soul may at once be made, that inquisitive wonder lays hold upon a compiler of such tables, as to whether the laboriously-collated figures are even so much as scanned by one single reader, a wonder which is only less painful than the haunting fear lest out of two hundred sets of prices there may creep in some mistake, and that somebody will "spot it."

However, casting aside wonder and fear, it is well to proceed with the plot as regards electrical railway securities, and the following are some of the developments which have taken place in representative prices since New Year's Eve last year:—

| Stock. | 1908. Highest. | 1908. Lowest. | Dec. 31, 1907. | Now. | Rise or Fall. |
|---|---|---|---|---|---|
| Baker Street & Waterloo Deb. | 95½ | 87½ | 90⅝ | 95 | + 4⅜ |
| Central London Ord. | 84½ | 64 | 64½ | 65 | + ⅜ |
| Def. | 67⅝ | 42¼ | 43½ | 51 | + 7½ |
| City & South London Ord. | 46 | 26 | 44 | 26 | − 18 |
| Great Northern & City Pref. Ord. | 1⅜ | ⅜ | 1⅜ | ⅜ | − 1 |
| Metropolitan Con. | 45½ | 34½ | 41 | 36 | − 5 |
| Metropolitan District | 15⅝ | 9⅜ | 9½ | 13⅜ | + 4⅛ |

The steady advance in the prices of the Debenture stocks in companies under the wing of the Underground Electric Railways Co. of London, has been a noteworthy feature of the railway year. Central Londons derived benefit from the Franco-British Exhibition, but there has been a substantial decline in City and South London Ordinary stock. Metropolitan, too, is easier, although Districts show a rise on the year.

Changes in the electricity supply division are of peculiar interest on account of the recent activity of the shares in the Metropolitan list, due to the defeat of the London Electricity Bill. The table embraces Canadian General, and Mexican Light shares.

| Share. | 1908. Highest. | 1908. Lowest. | Dec. 31, 1907. | Now. | Rise or Fall. |
|---|---|---|---|---|---|
| Brompton Ordinary | 8⅝ | 6⅜ | 7½ | 8¼ | + 1 |
| Canadian General Electric | 111⅜ | 87½ | 98 | 109½ | +11½ |
| Charing Cross Ordinary | 4⅜ | 3⅞ | 4⅛ | 4⅛ | + ⅛ |
| Chelsea | 4¼ | 2⅜ | 3⅞ | 4⅛ | + ⅛ |
| City of London | 10⅝ | 9⅜ | 10 | 10¼ | + ⅛ |
| County of London | 9⅜ | 7⅜ | 7 | 9⅜ | + 2⅜ |
| Kensington | 8⅜ | 7⅞ | 8⅛ | 8 | — ⅛ |
| London Pref. | 5⅜ | 4¼ | 4⅛ | 5⅛ | + ⅛ |
| Metropolitan | 6⅜ | 4¼ | 5⅜ | 5⅜ | — ⅛ |
| Mexican Light and Power | 83½ | 47 | 50 | 76½ | + 26½ |
| Notting Hill | 12⅛ | 11 | 11 | 12½ | + 1½ |
| St. James' and Pall Mall | 9⅛ | 7⅛ | 7⅜ | 8⅝ | + 1⅛ |
| Westminster | 9⅛ | 7⅜ | 8⅛ | 8⅜ | + ⅛ |

What appears to be the most interesting feature in the above catalogue is the considerable difference between the highest and lowest prices for the current year. Attention may also be drawn to the fact that to-day's levels are not far short of being the best of the twelvemonth.

Telegraph issues have mostly fared badly, as this list shows:—

| Stock or share. | 1908. Highest. | 1908. Lowest. | Dec. 31, 1907. | Now. | Rise or Fall. |
|---|---|---|---|---|---|
| American Telegraph & Telephone | 135½ | 106½ | 106½ | 132½ | +26 |
| Anglo-American Deferred | 18 | 12⅜ | 17 | 15⅝ | − 1⅜ |
| ,, ,, Preferred | 106 | 97½ | 100 | 98 | − 2 |
| Direct U.S. Cable | 14½ | 12⅜ | 13⅝ | 13¼ | — ⅜ |
| Eastern Extension | 13⅝ | 11½ | 12⅝ | 11⅞ | — ¾ |
| Eastern Telegraph | 133½ | 129 | 132½ | 130½ | − 2 |
| Great Northern Telegraph | 34¼ | 28½ | 31½ | 31 | — ½ |
| Marconi | ⅞ | ⅝ | ⅞ | ⅝ | — |
| National Telephone Deferred | 122 | 107 | 108 | 117½ | + 9½ |
| ,, ,, Preferred | 112½ | 106 | 111 | 109½ | − 1½ |
| Western Telegraph | 1⅝ | 12½ | 12⅝ | 12⅝ | — ⅛ |
| Globe Telegraph Ordinary | 11 | 9⅛ | 9⅜ | 10⅜ | + ⅛ |
| ,, ,, Preferred | 14½ | 12⅝ | 12½ | 13⅜ | + ⅜ |

What with Mr. Marconi and Mr. Henniker Heaton, to say nothing of the setback in trade, cable shares have had much to contend with, and it will be noticed, with some surprise, that Globe Telegraph and Trust Ordinary and Preference are higher than they stood a year ago.

In our last list we take some of the chief traction descriptions, and set out the figures in the same way as those treated above:—

| Stock or share. | 1908. Highest. | 1908. Lowest. | Dec. 31, 1907. | Now. | Rise or Fall. |
|---|---|---|---|---|---|
| Anglo-Argentine 2nd Pref. | 9⅜ | 7⅞ | 8 | 9⅜ | + 1⅜ |
| British Columbia Electric Def. | 140 | 124½ | 125½ | 136½ | +11 |
| British Elec. Traction Ordinary | 1⅜ | ⅞ | 1⅛ | 1⅛ | — 1/16 |
| ,, ,, Preference | 5¼ | 3½ | 5⅛ | 3⅞ | — 1⅛ |
| London United Trams Preference | 8⅛ | 4¼ | 7⅞ | 4⅛ | — 3⅞ |
| Mex. Trams Com. | 147⅝ | 65 | — | 136½ | — |
| Sao Paulo Trams | 165 | 115 | 114½ | 159½ | +45 |
| Rio de Janeiro Trams | 81 | 44½ | — | 80½ | — |

Manufacturing shares have been irregular, so far as net movements of the year are concerned. Callender's, for instance, are ½ lower at 9½, while Henley's show £1 rise at 12. British Aluminium have come down from 3⅜ to 2 1/16. British Insulated rose from 6½ to 6⅞, and Telegraph Constructions from 29½ to 31½. Hope springs as eternally as ever that the outlook for financial affairs of all kinds is gradually becoming more settled, and in venturing to offer the readers of these notes the best of wishes for a prosperous New Year, the hope is appended that everything those readers buy will go up, and that everything they sell will go down.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present Issue. | NAME. | Stock or Share. * | Dividends for the last four years. 1904. | 1905. | 1906. | 1907. | Closing Quotations Dec. 18th. | Closing Quotations Dec. 29th. | Business done week ended Dec. 29th, 1908. Highest | Lowest. | Rise + or Fall — | Present Yield per cent. £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25,000 | Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 | 10 | Nil | Nil | Nil | Nil | 2¼ — 3½ | 2⅜ — 2⅝ | .. | .. | — ⅜ | Nil. |
| 136,700 | Do. do. 5 % Debs., Nos. 1 to 1,250 Red. | 100 | Nil | 5 % | 5 % | 5 % | 92 — 95 | 94 — 97 | .. | .. | +2 | 5 3 1 |
| $131,551,400 | American Telephone & Telegraph, Cap. Stock .. | $100 | 7¾% | 7¾% | 8 % | 8 % | 131 —134 | 131 —134 | .. | .. | .. | 5 19 5 |
| $58,000,000 | Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000 | $1000 | 4 % | 4 % | 4 % | 4 % | 95 — 97 | 95 — 97 | .. | .. | .. | 4 2 6 |
| 598,180 | Anglo-American Telegraph .. .. .. .. | Stock | 2⅜% | 3½% | 3¾% | 3¾% | 55 — 58 | 56 — 59 | .. | .. | +1 | 5 18 8 |
| 3,200,910 | Do. do. do. 6 % Pref. .. .. .. | Stock | 5¾% | 6 % | 6 % | 6 % | 95½ — 97½ | 97 — 99 | 99 | 97 | +1½ | 6 1 3 |
| 3,200,910 | Do. do. do. Deferred .. .. .. | Stock | Nil | ⅜% | 1⅜% | 1 % | 15⅝ — 15⅞ | 15¾ — 15⅞ | 16 | 15⅞ | + ⅛ | 6 7 0 |
| 50,000 | Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red. | 100 | .. | 5 % | 5 % | 5 % | 100 —102 | 100 —102 | .. | .. | .. | 4 18 0 |
| 44,000 | Chili Telephone, Nos. 1 to 44,000 .. .. .. | 5 | 8 % | 8 % | 8 % | 8 % | 8 — 8½ | 8 — 8½ | .. | .. | .. | 4 14 1 |
| 2,883,376 | Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red. | Stock | 4 % | 4 % | 4 % | 4 % | 85 — 87 | 87 — 89 | 87 | .. | .. | 4 12 0 |
| 16,000 | Cuba Telegraph .. .. .. .. .. | 10 | 5 % | 5 % | 5 % | 6 % | 7½ — 8½ | 7½ — 8½ | .. | .. | .. | 7 1 2 |
| 6,000 | Do. 10 % Pref. .. .. .. .. | 10 | 10 % | 10 % | 10 % | 10 % | 16½ — 17½ | 16½ — 17½ | 16½ | .. | + ½ | 5 14 3 |
| 12,931 | Direct Spanish Telegraph, Ord. .. .. .. | 5 | 4 % | 4 % | 4 % | 4 % | 3 — 3½ | 3 — 3½ | .. | .. | .. | 5 14 3 |
| 6,000 | Do. do. 10 % Cum. Pref. .. | 5 | 10 % | 10 % | 10 % | 10 % | 8 — 9 | 8 — 9 | .. | .. | .. | 5 8 1 |
| 30,000 | Do. do. 4½ % Debs. .. .. .. | 50 | 4½% | 4½% | 4½% | 4½% | 100 —103 | 101 —104 | .. | .. | +1 | 8 13 2 |
| 60,710£ | Direct United States Cable .. .. .. | 20 | 3½% | 4¼% | 4⅝% | 4½% | 12⅜ — 13½ | 12⅝ — 13⅝ | 13⅛ | 12⅝ | + ⅜ | 6 7 4 |
| 48,000£ | Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R. | 100 | 4½% | 4½% | 4½% | 4½% | 101 —103 | 102 —104 | .. | .. | +1 | 4 6 7 |
| 4,000,000 | Eastern Telegraph, Ord. Stock.. .. .. .. | Stock | 7 % | 7 % | 7 % | 7 % | 129 —134 | 128 —133 | 130 | 128½ | —1 | 5 5 3 |
| 2,000,000 | Do. 8½ % Pref. Stock.. .. .. .. | 100 | 8½% | 8½% | 8½% | 8½% | 82 — 85 | 82 — 85 | 83½ | 83½ | .. | 4 2 4 |
| 1,896,706 | Do. 4 % Mort. Deb. Stock. Red. .. | Stock | 4 % | 4 % | 4 % | 4 % | 103½ —105½ | 103½ —105½ | .. | .. | .. | 3 17 8 |
| 300,000 | Eastern Extension, Australasia, and China Tele. | 10 | 7 % | 7 % | 7 % | 7 % | 11⅛ — 11⅞ | 11⅛ — 12⅛ | 11⅛ | 11⅜ | + ⅛ | 5 14 3 |
| 752,400 | Do. 4 % Deb. Stock .. .. .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 101 —103 | 101 —103 | 104½ | 103 | .. | 3 17 8 |
| 269,700 | East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 100 —102 | 100 —102 | .. | .. | .. | 3 18 5 |
| 200,000£ | Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000 | 25 | 4 % | 4 % | 4 % | 4 % | 99½ —101½ | 100 —102 | .. | .. | + ½ | 3 18 5 |
| 181,127 | Globe Telegraph and Trust .. .. .. .. | 10 | 5⅜% | 5½% | 5½% | 5½% | 9½ — 10⅜ | 10 — 10½ | 10⅝ | 9⅞ | + ⅛ | 5 14 8 |
| 181,127 | Do. do. 6 % Pref... .. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 12⅛ — 13⅜ | 13⅛ — 13⅜ | 13⅜ | 13½ | + ¼ | 4 7 3 |
| 150,000 | Great Northern Telegraph, of Copenhagen.. .. | 10 | 24 % | 24% | 20 % | 20 % | 30 — 32 | 30 — 32 | 31⅛ | .. | .. | 6 5 0 |
| 14,800£ | Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red. | 100 | 4½% | 4½% | 4½% | 4½% | 101 —103 | 102 —104 | .. | .. | +1 | 4 6 7 |
| 17,000 | Indo-European Telegraph .. .. .. .. | 25 | 13 % | 13 % | 13 % | 13 % | 52 — 55 | 52 — 55 | 53½ | 53 | .. | 6 16 4 |
| $41,380,400 | Mackay Companies Common .. .. .. .. | $100 | 1 % | 2 % | 3¾% | 4 % | 74 — 78 | 74 — 78 | .. | .. | .. | 5 2 7 |
| $50,000,000 | Do. do. 4% Cum. Pref. .. .. .. | $100 | 4 % | 4 % | 4 % | 4 % | 71 — 74 | 71 — 74 | .. | .. | .. | 5 12 8 |
| 394,190 | Marconi's Wireless Telegraph .. .. .. .. | 1 | Nil | Nil | Nil | Nil | ⅜ — ⅝ | ⅜ — ⅝ | .. | .. | .. | Nil |
| 72,680 | Monte Video Telephone Co., Ltd. Ord. .. .. | 1 | 4 % | 5 % | 6 % | 6 % | ¾ — 1 | ¾ — 1 | .. | .. | .. | 6 0 0 |
| 86,492 | Do. do. do. 5 % Pref. .. .. | 1 | 5 % | 5 % | 5 % | 5 % | 5⅜ — 5⅝ | 5⅜ — 5⅝ | .. | .. | .. | 5 3 11 |
| 2,225,000 | National Telephone, Pref. Stock .. .. .. | 100 | 6 % | 6 % | 6 % | 6 % | 108½ —110½ | 108⅝ 110¼ | 110 | 108½ | .. | 5 8 7 |
| 8,725,000 | Do. do. Def. Stock .. .. .. .. | 100 | 5 % | 5 % | 5 % | 6 % | 116½ —118½ | 116 —118½ | 117½ | 116½ | .. | 5 1 3 |
| 15,000 | Do. do. 6 % Cum. 1st. Pref. .. .. | 10 | 6 % | 6 % | 6 % | 6 % | 10½ — 11½ | 10½ — 11½ | 11 | .. | .. | 5 4 4 |
| 15,000 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | 6 % | 6 % | 5 % | 5 % | 10½ — 11½ | 10½ — 11½ | .. | .. | .. | 4 6 11 |
| 250,000 | Do. do. 5 % Non-cum. 3rd P., 1 to 250,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5 5/16 — 5 7/16 | 5 5/16 — 5 7/16 | 5 15/32 | .. | .. | 4 7 1 |
| 2,000,000 | Do. do. 8½ % Deb. Stock Red. .. | Stock | 8½% | 8½% | 8½% | 8½% | 98 —100 | 98 —100 | 99½ | .. | .. | 8 10 4 |
| 1,716,598 | Do. do. 4 % Deb. Stock Red. .. .. | 100 | 4 % | 4 % | 4 % | 4 % | 100½ —102½ | 101 —103 | 101⅜ | .. | .. | 3 18 1 |
| 179,313 | Oriental Telep. and Elec. 1 to 171,504, fully paid .. | 1 | 6¼% | 7 % | 7 % | 8 % | 1⅛ — 1⅜ | 1 5/16 — 1 7/16 | .. | .. | + 1/16 | 5 16 2 |
| 50,000 | Do. do. do. 6 % Cum. Pref... .. | 1 | 6 % | 6 % | 6 % | 6 % | 1⅛ — 1½ | 1⅛ — 1½ | .. | .. | .. | 4 16 0 |
| 99,100 | Do. do. do. 4 % Red. Deb. Stock .. | 100 | .. | 4 % | 4 % | 4 % | 90 — 92 | 90 — 92 | .. | .. | .. | 4 7 0 |
| 99,400 | Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000 | 10 | 4 % | 4 % | 4 % | 4 % | 101 —103 | 101 —103 | .. | .. | .. | 3 17 4 |
| 11,839£ | Reuter's .. .. .. .. .. .. | 8 | 5 % | 5 % | 5 % | 5 % | 7 — 8 | 7 — 8 | 7⅛ | .. | .. | 5 0 0 |
| 99,100 | Telephone Co. of Egypt, 4½ % Deb. Red. .. .. | 100 | .. | 4½% | 4½% | 4½% | 100½ —102½ | 100½ —102½ | .. | .. | .. | 4 7 10 |
| 3,083 | Submarine Cables Trust .. .. .. .. .. | Cert. | 6 % | 6 % | 6 % | 6 % | 127 —130 | 127 —130 | .. | .. | .. | 4 12 4 |
| 100,000 | United River Plate Telephone .. .. .. .. | 5 | 8 % | 8 % | 8 % | 8 % | 6⅜ — 7⅛ | 6⅜ — 7⅛ | .. | .. | .. | 5 16 4 |
| 40,000 | Do. 5 % Cum. Pref., Nos. 1 to 40,000 | 5 | 5 % | 5 % | 5 % | 5 % | 5 — 5½ | 5 — 5½ | .. | .. | .. | 4 10 11 |
| 80,008 | W. Coast of America, 1 to 80,000 & 53,001 to 53,008 | 2½ | Nil | Nil | 2½% | 2½% | 1¼ — 1½ | 1¼ — 1½ | .. | .. | .. | 4 3 4 |
| 150,000 | Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 % | 4 % | 4 % | 4 % | 101 —103 | 101 —103 | .. | .. | .. | 3 17 8 |
| 207,930 | Western Telegraph, Ltd., Nos. 1 to 207,930.. .. | 10 | 7 % | 7 % | 7 % | 7 % | 12½ — 13 | 12½ — 13 | 12⅞ | 12 9/16 | .. | 5 7 8 |
| 800,000 | Do. do. 4 % Deb. Stock Red. .. | 100 | 4 % | 4 % | 4 % | 4 % | 102 —104 | 102 —104 | .. | .. | .. | 3 16 11 |
| 88,321 | West India and Panama Telegraph .. .. .. | 10 | Nil | Nil | Nil | Nil | ⅛ — ¼ | ⅛ — ¼ | .. | .. | .. | Nil |
| 34,563 | Do. do. 6 % Cum. 1st Pref. .. .. | 10 | 6 % | 5 % | 8 % | 6 % | 7⅝ — 8¼ | 7⅝ — 8⅜ | 7⅞ | .. | .. | 7 7 8 |
| 4,669 | Do. do. 6 % Cum. 2nd Pref. .. .. | 10 | Nil | Nil | Nil | £2 6 | 7½ — 8½ | 7½ — 8½ | .. | .. | .. | 2 14 1 |
| 80,000£ | Do. do. 5 % Debs., Nos. 1 to 1,800 .. | 100 | 5 % | 5 % | 5 % | 5 % | 102 —104 | 102 —104 | .. | .. | .. | 4 16 2 |

## ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 320,000 | Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097 | 5 | 8 % | 8 % | 8 % | 9 % | 9½ — 9¾ | 9½ — 9⅝ | 9 7/16 | 9 11/32 | .. | 4 14 9 |
| 260,007 | Do. 6 % Cum. Prefs., 1 to 260,007 .. | 5 | 5¼% | 5¼% | 5¼% | 5¾% | 6⅜ — 6⅝ | 6 5/16 — 6 9/16 | 6 13/32 | .. | — 1/16 | 4 8 6 |
| 266,600 | Do. Permanent, 6 % Deb. Stock, 1888 | 100 | 6 % | 6 % | 6 % | 6 % | 143 —148 | 143 —148 | .. | .. | .. | 4 2 2 |
| 285,100 | Auckland E. Trams, 5 % 1st Mort. Deb. Stock .. | 100 | 5 % | 5 % | 5 % | 5 % | 102 —105 | 102 —105 | .. | .. | .. | 4 15 3 |
| 880,000 | Babcock & Wilcox, 1 to 530,000.. .. .. .. | 1 | 20 % | 20 % | 20 % | 20 % | 3⅞ — 4 | 3⅞ — 4 | 79/4½ | 78/6 | .. | 5 0 0 |
| 100,000 | Do. do. 6 % Cum. Pref., 1 to 100,000 .. | 1 | 6 % | 6 % | 6 % | 6 % | 1 7/16 — 1 9/16 | 1 7/16 — 1 9/16 | 42/6 | 41/3 | .. | 3 13 10 |
| 60,000 | British Aluminium, Ord., 1 to 40,000 .. .. .. | 5 | 7 % | 7 % | 7 % | 7 % | 1⅝ — 2⅛ | 1⅝ — 2⅛ | 63/- | 63/9 | .. | 15 11 2 |
| 60,000 | Do. do. 7 % Cum. Pref. .. .. .. | 5 | 7 % | 7 % | 7 % | 7 % | 3 — 3½ | 3 — 3½ | .. | .. | .. | 10 0 0 |
| 40,000 | Do. do. "A" 6 % Cum. Pref. .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 3⅝ — 4⅛ | 3⅝ — 4⅛ | 82/6 | .. | .. | 7 1 2 |
| 12,897 | Do. do. 4 % Funding Certs. .. .. | 5 | 4 % | 4 % | 4 % | 4 % | 3⅞ — 4⅛ | 3⅞ — 4⅛ | .. | .. | .. | 4 8 11 |
| 43,473 | Do. do. 5 % 1st Mort. Deb. Stock Red. | Stock | 5 % | 5 % | 5 % | 5 % | 105 —108 | 105 —108 | .. | .. | .. | 4 12 7 |
| 300,000 | Do. do. 5½ % Loch Leven Debs. .. | 100 | .. | .. | 5½% | 5½% | 98½ —100½ | 98½ —100½ | .. | .. | .. | 5 9 5 |
| 400,000 | British Columbia E. Rail Def. Ord. Stock .. .. | 100 | 6 % | 6 % | 6 % | 8 % | 135 —138 | 135 —138 | 137 | .. | .. | 5 15 11 |
| 400,000 | Do. 5 % Pref. Ord. Stock .. .. .. | 100 | 5 % | 5 % | 5 % | 5 % | 116 —120 | 116 —120 | 118⅝ | .. | .. | 4 11 4 |
| 800,000 | Do. 5 % Cum. Perp. Pref. Stock .. .. | 100 | 5 % | 5 % | 5 % | 5 % | 107½ —109½ | 107½ —109½ | 109½ | 109½ | .. | 4 11 9 |
| 233,000 | Do. 4½ % 1st Mort. Debs., 1 to 6,250 .. .. | 40 | 4½% | 4½% | 4½% | 4½% | 102 —104 | 102 —104 | .. | .. | .. | 10 15 6 |
| 220,000 | Do. 4½ % Vancouver Power Debs., 1 to 2,200 | 100 | 4½% | 4½% | 4½% | 4½% | 103 —106 | 103 —106 | .. | .. | .. | 4 4 11 |
| 133,301 | British Electric Traction .. .. .. .. | 10 | 6 % | 3 % | Nil | Nil | 1 5/16 — 1 7/16 | 1 5/16 — 1 7/16 | .. | .. | .. | Nil |
| 161,437 | Do. do. 6 % Cum. Pref. .. .. .. | 10 | 6 % | 6 % | 6 % | 3 % | 3⅝ — 4 | 3½ — 4 | 76/3 | 72/6 | — ⅛ | 7 10 0 |
| 1,473,653 | Do. do. 5 % Perp. Deb. Stock .. | Stock | 5 % | 5 % | 5 % | 5 % | 92 — 97 | 92 — 97 | 93½ | .. | .. | 5 3 1 |
| 528,936 | Do. do. 4½ % 2nd Deb. Stock Red. | 100 | 4½% | 4½% | 4½% | 4½% | 73 — 75 | 73 — 75 | 74½ | .. | .. | 6 0 1 |
| 100,000 | British Insulated and Helsby Cables .. .. | 5 | 8 % | 8 % | 10 % | 10 % | 6½ — 7 | 6½ — 7 | 6⅝ | .. | .. | 7 2 10 |
| 100,000 | Do. do. 6 % Cum. Pref. .. .. .. | 5 | 6 % | 6 % | 6 % | 6 % | 6⅜ — 6½ | 6⅜ — 6½ | .. | .. | .. | 4 12 4 |
| 500,000 | Do. do. 4½ % 1st Mort. Deb. Red. .. | 100 | 4½% | 4½% | 4½% | 4½% | 105 —108 | 105 —108 | .. | .. | .. | 4 3 4 |
| 208,440 | British Thomson-Houston 4½ % 1st Mort. Debs. .. | 100 | 4½% | 4½% | 4½% | 4½% | 91 — 96 | 91 — 96 | .. | .. | .. | 4 13 9 |
| 400,000 | British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000 | 5 | Nil | Nil | Nil | Nil | ⅜ — ⅝ | ⅜ — ⅝ | 7/6 | .. | .. | Nil |
| 1,016,353 | Do. do. 4 % Mort. Deb. Stock .. | 100 | 4 % | 4 % | 4 % | 4 % | 43 — 48 | 43 — 48 | 46½ | .. | .. | 8 6 8 |
| 50,000 | ‡Browett, Lindley & Co., Ord. .. .. .. .. | 1 | Nil | Nil | Nil | Nil | ⅛ — ¼ | ⅛ — ¼ | .. | .. | .. | Nil |
| 50,000 | ‡ Do. do. 6 % Cum. Pref. .. .. .. | 1 | Nil | Nil | Nil | Nil | 14/6 to 15/6 | 14/6 to 15/6 | .. | .. | .. | Nil |
| 105,731 | Brush Electrical Engineering, Ord., 1 to 105,731 .. | 2 | Nil | 2½% | Nil | Nil | .. | .. | .. | .. | .. | Nil |
| 150,000 | Do. do. Non-cum. 6 % Pref. .. .. | 2 | 6 % | 6 % | Nil | Nil | .. | .. | .. | .. | .. | Nil |
| 125,000£ | Do. do. 4½ % Perp. Deb. Stock .. | Stock | 4½% | 4½% | 4½% | 4½% | 65 — 70 | 65 — 70 | .. | .. | .. | 6 8 7 |
| 125,000£ | Do. do. 4½ % Perp. 2nd Deb. Stock.. | Stock | 4½% | 4½% | 4½% | 4½% | 49 — 53 | 49 — 53 | .. | .. | .. | 8 9 10 |
| 137,610 | Calcutta Trams, 1 to 137,610 .. .. .. .. | 5 | 8 % | 8 % | 8 % | 6 % | 4¼ — 5 | 4¼ — 5 | 96/3 | .. | .. | 6 0 0 |
| 45,304 | Do. 5 % Cum. Pref., Nos. 1 to 29,880.. | 5 | .. | 5 % | 5 % | 5 % | 4⅝ — 5¼ | 4⅝ — 5¼ | .. | .. | .. | 4 15 3 |
| 850,000 | Do. 4½ % 1st Deb. Stock.. .. .. | 100 | 4½% | 4½% | 4½% | 4½% | 103 —106 | 103 —106 | .. | .. | .. | 4 4 11 |
| 85,000 | Callender's Cable Construction shares .. .. | 5 | 12½% | 15 % | 15 % | 15 % | 9 — 10 | 9 — 10 | .. | .. | .. | 7 10 0 |
| 40,000 | Do. do. 5 % Cum. Pref. .. .. .. | 5 | 5 % | 5 % | 5 % | 5 % | 5⅛ — 5⅝ | 5½ — 5⅝ | .. | .. | + ⅛ | 4 6 11 |
| 800,000 | Do. do. 4½ % 1st Mort. Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | 4½% | 107½ —109½ | 108 —110 | .. | .. | + ½ | 4 1 10 |
| 491,222 | Cape E Trams., 1 to 491,222 .. .. .. .. | 1 | 5 % | Nil | Nil | Nil | ⅜ — ½ | ⅜ — ½ | .. | .. | — ⅛ | Nil |
| 450,000 | Castner-Kellner Alkali, 1 to 450,000 .. .. .. | 1 | 4 % | 6 % | 8 % | 12 % | 1⅜ — 1⅝ | 1⅜ — 1⅝ | 31/9 | 31/- | .. | 7 10 4 |
| 210,153 | Do. do. 4½ % 1st Mort. Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 103 —107 | 103 —107 | .. | .. | .. | 4 6 11 |
| 1,893,610 | Central London Railway, Ord. Stock .. .. .. | Stock | 4 % | 4 % | 4 % | 3 % | 64 — 66 | 64 — 66 | 65 | .. | .. | 4 10 11 |
| 553,195 | Do. do. 4 % Pref. Stock .. .. | Stock | 4 % | 4 % | 4 % | 4 % | 84 — 86 | 84 — 86 | 85½ | 84½ | .. | 4 13 0 |
| 553,195 | Do. do. Def. do. .. .. | Stock | 4 % | 4 % | 4 % | 2 % | 50 — 52 | 50 — 52 | 52 | .. | .. | 3 16 11 |
| 1,480,000 | City and South London Railway .. .. .. | Stock | 2½% | 1⅞% | 2½% | 2½% | 28 — 29 | 25½ — 26½ | 28½ | 25½ | —2½ | 8 0 5 |

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

| Present Issue. | NAME. | Stock or Share. | Dividends for the last four years. 1904. | 1905. | 1906. | 1907. | Closing Quotations Dec. 18th. | Closing Quotations Dec. 29th. | Business done week ended Dec. 29th, 1908. Highest | Lowest. | Rise + or Fall — | Present Yield per cent. £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 85,000 | Crompton & Co., Nos. 1 to 85,000 | * | 2½% | 2½% | 5 % | 5 % | 1⅝— 1¾ | 1⅝— 1¾ | .. | .. | .. | 10 0 0 |
| 100,000 | Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red. | .. | 5 % | 5 % | 5 % | 5 % | 98 —101 | 98 —101 | .. | .. | .. | 4 19 0 |
| 260,000 | Dick, Kerr & Co., 1 to 260,000 | 1 | 10 % | 10 % | 10 % | 10 % | 1⅞— 1⅞ | 1⅝— 1⅝ | .. | .. | .. | 7 2 10 |
| 805 000 | Do. do. 6 % Cum. Pref., 1 to 805,000 | 1 | 6 % | 6 % | 6 % | 6 % | 1⅛— 1⅛ | 1⅛— 1⅛ | .. | .. | .. | 5 1 1 |
| 276,880 | Do. dc. 4½ % Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 101 —104 | 101 —104 | .. | .. | .. | 4 6 7 |
| 60,000 | Dublin United Trams. (1896), 1 to 60,000 | 10 | 6 % | 6% | 6 % | 6½% | 11⅜— 12½ | 11⅜— 12½ | .. | .. | .. | 5 4 0 |
| 60,000 | Do. 6 % Pref. between 1 and 60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 13 — 14 | 13 — 14 | .. | .. | .. | 4 5 9 |
| 99,261 | Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261 | 5 | 2½% | 4½% | 4½% | 4½% | ⅞— ⅞ | ⅞— ⅞ | .. | .. | .. | 16 15 3 |
| 17,189 | Do. "A" shares, 01—017,189 | 5 | 2½% | 4½% | 4½% | 4½% | 1⅜— 2⅛ | 1⅜— 2⅛ | 30/- | .. | .. | 8 6 9 |
| 317,875 | Do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 76 — 79 | 76 — 79 | .. | .. | .. | 5 1 8 |
| 67,720 | Do. 5 % 2nd Deb. Stock Prov. Certs. all pd. | 100 | 5 % | 5 % | 5 % | 5 % | 86 — 89 | 86 — 89 | .. | .. | .. | 5 12 4 |
| 112,100 | Electric Construction, 1 to 112,100 | 2 | 4 % | Nil | Nil | Nil | ⅜— ⅝ | ⅜— ⅝ | .. | .. | .. | Nil |
| 31,390 | Do. do. 7 % Cum. Pref., 1 to 31,390 | 2 | 7 % | 7 % | 7 % | 7 % | 1 — 1⅛ | 1 — 1⅛ | .. | .. | .. | 9 6 8 |
| 25,000 | General Electric Co. (1900), 5 % Cum. Pref. | 10 | 5 % | 5 % | 5 % | 5 % | 7½— 7⅝ | 7½— 7⅝ | .. | .. | .. | 6 9 0 |
| 200,000 | Do. do 4 % Mort Deb. | Stock | 4 % | 4 % | 4 % | 4 % | 83 — 87 | 83 — 87 | .. | .. | .. | 4 12 0 |
| 78,000 | Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000 | 10 | 4 % | 4 % | 4 % | ¼% | ½— ¾ | ½— ¾ | .. | .. | .. | 6 13 4 |
| 96,000 | Greenwood & Batley, 7 % Cum. Pref. | 10 | 7 % | 7 % | 7 % | 7 % | 10½— 10⅝ | 10½— 10⅝ | .. | .. | .. | 6 10 3 |
| 80,000 | Do. do. 5 % Mort. Debs. | 100 | 5 % | 5 % | 5 % | 5 % | 102 —103 | 102 —103½ | .. | .. | .. | 4 16 10 |
| 40,000 | Henley's (W. T.), Telegraph Works, Ord. | 5 | 15 % | 15% | 15 % | 15% | 11½— 12½ | 11½— 12½ | .. | .. | .. | 6 0 0 |
| 40,000 | Do. do. 4½ % Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 5 — 5½ | 5 — 5½ | 5 | .. | .. | 4 1 10 |
| 150,000 | Do. do. 4½ % Mort. Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 105 — 107 | 105½—107½ | 105½ | .. | + ½ | 4 8 9 |
| 50,000 | India-Rubber, Gutta-percha & Telegraph Works. | 10 | 5 % | 10% | 10 % | 10 % | 16⅝— 17⅜ | 16⅝— 17⅜ | 16⅝ | 16⅝ | .. | 8 1 7 |
| 37,500 | †Liverpool Overhead Railway, Ord. | 10 | 1½% | Nil | Nil | ¾% | 1 — 1½ | 1 — 1½ | .. | .. | .. | 4 7 6 |
| 10,000 | † Do. do. Pref., fully paid | 10 | 5 % | 5 % | 5 % | 5 % | 4 — 4½ | 4 — 4½ | .. | .. | .. | 11 2 3 |
| 600,070 | London United Trams. (1901), 1 to 50,007 | 10 | 6 % | 8 % | 8 % | 8 % | 6½— 6⅝ | 6½— 6⅝ | .. | .. | .. | 4 8 11 |
| 899,930 | Do. do. 60,008 to 100,000 | 10 | 6 % | 8 % | 8 % | 8 % | 6⅝— 6⅞ | 6⅝— 6⅞ | .. | .. | .. | 4 8 11 |
| 125,000 | Do. do. 5 % Cum. Pref., 1 to 125,000 | 10 | 5 % | 5 % | 5 % | 5 % | 4½— 5½ | 4½— 5 | 97/6 | 90/- | — ⅝ | 10 0 0 |
| 1,331,000 | Do. do. 4 % 1st Mort. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 67 — 72 | 68 — 72 | .. | .. | + ½ | 5 11 1 |
| 5,782,062 | Metropolitan Consolidated | 100 | 3 % | 23% | 1 % | ¾% | 35 — 36 | 35½— 36½ | 36⅜ | 35⅝ | + ⅜ | 1 7 5 |
| 2,640,914 | Do. Surplus Lands | 100 | 23% | 25% | 23% | 23% | 67 — 69 | 68 — 70 | 69 | 67½ | +1 | 3 18 7 |
| 3,235,000 | Do. District | 100 | Nil | Nil | Nil | Nil | 13½— 13⅝ | 13⅜— 14 | 13⅞ | 13⅜ | + ⅛ | Nil |
| 314,016 | Metropolitan Electric Trams., Defd. | 1 | Nil | Nil | Nil | Nil | ⅜— ⅝ | ⅜— ⅝ | .. | .. | .. | Nil |
| 500,000 | Do. do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | ¼— ⅜ | ¼— ⅜ | 16/- | .. | .. | 5 19 5 |
| 823,800 | Do. do. 4½ % Deb. Stock Red. | 100 | 4½% | 4½% | 4½% | 4½% | 93 — 96 | 93 — 96 | 95 | .. | .. | 4 13 9 |
| 245,500 | Potteries E. Tre. | 1 | 5 % | 4 % | 4 % | 4 % | ¼— ⅜ | ¼— ⅜ | 6/8 | .. | .. | 8 0 0 |
| 245,500 | Do. 5 % Cum. Pref. | 1 | 5 % | 5 % | 5 % | 5 % | ¼— ⅜ | ¼— ⅜ | .. | .. | .. | 6 17 11 |
| 245,000 | Do. 4½ % Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 90 — 93 | 90 — 93 | .. | .. | .. | 4 14 9 |
| 37,350 | Telegraph Construction and Maintenance | 12 | 15 % | 15 % | 15 % | 17½% | 30½— 32½ | 30⅜— 32½ | 31½ | .. | .. | 7 14 11 |
| 150,000 | Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909 | 100 | 4 % | 4 % | 4 % | 4 % | 101½—103½ | 101½—103½ | .. | .. | .. | 3 17 8 |
| 1,000,000 | Underground Electric Railway, 5% Prior Lien | .. | .. | .. | .. | .. | 93 — 94 | 93½— 94½ | 94½ | 93½ | + ½ | .. |
| 2,800,000 | Do. do. 4½% Bonds | .. | .. | .. | .. | .. | 73 — 75 | 74 — 76 | .. | .. | +1 | .. |
| 4,900,000 | Do. do. 6% Income Bonds | .. | .. | .. | .. | .. | 20 — 22 | 21 — 23 | 21⅜ | 21⅛ | +1 | .. |
| 66,666 | Willans & Robinson, 1 to 80,000 & 80,001 to 116,666 | 1 | Nil | Nil | Nil | 10 % | ⅝— ¾ | ⅝— ¾ | .. | .. | .. | 10 0 0 |
| 66,666 | Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666 | 5 | Nil | Nil | .. | 6 % | 2⅜— 2 | 2½— 2⅝ | 47/6 | .. | .. | 10 8 8 |
| 246,404 | Do. 4 % 1st Mort. Deb. Stock | | 4 % | 4 % | 4 % | 4 % | 68 — 72 | 68 — 72 | .. | .. | .. | 5 11 1 |

### ELECTRICITY SUPPLY COMPANIES.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15,000 | Bromley (Kent) E.L. & P., 1 to 15,000 | 5 | 5⅛% | 5⅛% | 5⅛% | 5⅛% | 4⅜— 4⅞ | 4½— 5 | 97/6 | .. | + ⅛ | 5 10 0 |
| 70,000 | Do. do. 4½ % 1st. deb. stock | 100 | 4½% | 4½% | 4½% | 4½% | 94 — 98 | 94 — 98 | .. | .. | .. | 4 10 0 |
| 30,275 | Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000 | 5 | 10 % | 10 % | 10 % | 10 % | 8½ — 9 | 8½ — 9 | .. | .. | .. | 5 12 8 |
| 9,725 | Do. do. 7 % Cum. Pref. | 5 | 7 % | 7 % | 7 % | 7 % | 8 — 8½ | 8 — 8½ | .. | .. | .. | 4 2 4 |
| 886,876 | Central Electric Supply 4 % Guar. Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 98 — 101 | 99 —101 | .. | .. | .. | 3 19 3 |
| 80,000 | Charing Cross and Strand Electricity Supply | 5 | 8 % | 5 % | 5 % | 5 % | 4⅜— 4⅞ | 4⅜— 4⅞ | 91/6 | 90/3 | .. | 5 2 7 |
| 80,000 | Do. do. 4½ % Cum. Pref. | 5 | 4½% | 4½% | 4½% | 4½% | 4⅜— 4⅝ | 4⅜— 4⅝ | .. | .. | .. | 4 17 4 |
| 80,000 | Do. "City Undertaking" 4½ % Cum. Prf. | 5 | 4½% | 4½% | 4½% | 4½% | 3⅞— 4⅛ | 3⅞— 4⅛ | .. | .. | .. | 5 16 2 |
| 445,736 | Do. do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 4 % | 98 —100 | 97⅜— 99½ | 99⅜ | .. | — ½ | 4 0 5 |
| 49,486 | Chelsea Electricity Supply, Ord. | 5 | 6 % | 6 % | 4½% | 4½% | 3⅞— 4⅛ | 3⅞— 4⅛ | .. | .. | .. | 5 5 11 |
| 175,000 | Do. do. 4½ % Deb. Stock Red. | Stock | 4½% | 4½% | 4½% | 4½% | 101 —104 | 103 —106 | 105 | .. | +2 | 4 4 11 |
| 70,595 | City of London Elec. Lighting, Ord. 40,001—110,595 | 10 | 6 % | 6 % | 6 % | 6 % | 10⅛— 10⅜ | 10⅛— 10⅜ | 10⅜ | 10 7/8 | .. | 5 11 8 |
| 40,000 | Do. 6 % Cum. Pref., 1 to 40,000 | 10 | 6 % | 6 % | 6 % | 6 % | 12⅜— 13 | 12⅛— 13 | .. | .. | .. | 4 12 4 |
| 400,000 | Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd. | .. | 5 % | 5 % | 5 % | 5 % | 123 —125 | 123 —125 | 124⅛ | .. | .. | 4 0 0 |
| 300,000 | Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd. | 100 | 4½% | 4½% | 4½% | 4½% | 101 —103 | 101 —103 | .. | .. | .. | 4 7 5 |
| 50,000 | County of Durham Electrical Power, Ord. | 5 | £3 7 0 | 4 % | 4 % | 2 % | 2⅜— 2⅝ | 2⅜— 2⅝ | .. | .. | .. | 3 6 8 |
| 50,000 | Do. do. 5 % Pref. | 5 | 5 % | 5 % | 5 % | 5 % | 3⅞— 4 | 3⅞— 4 | .. | .. | .. | 6 5 0 |
| 200,000 | Do. do. do. 5 % 1st Mtg. Deb. | Stock | .. | .. | .. | .. | 99 —101 | 99 —101 | .. | .. | .. | .. |
| 40,000 | County of London Electric Lighting, Ord. 1—40,000 | 10 | 4½% | 5 % | 5 % | 5 % | 8⅞— 9⅛ | 8⅞— 9⅛ | 9 | .. | + ⅛ | 5 7 9 |
| 50,026 | Do. do. 6 % Pref., 40,001—60,000 | 10 | 6 % | 6 % | 6 % | 6 % | 10⅝— 11⅛ | 10⅝— 11⅛ | 11 | .. | .. | 5 6 8 |
| 400,000 | Do. do. 4½ % Deb. Stock | .. | 4½% | 4½% | 4½% | 4½% | 107 —110 | 107 —110 | .. | .. | .. | 4 1 10 |
| 400,000 | Do. do. 4½ % 2nd. Deb. Stock | Stock | 4½% | 4½% | 4½% | 4½% | 98 —101 | 99 —102 | 99⅜ | 99 | +1 | 4 8 8 |
| 80,000 | Edmundson's Electric Corporation, Ord. Shares | 5 | 7 % | 4 % | Nil | Nil | 1/32— 1/16 | 1/32— 1/16 | .. | .. | .. | Nil |
| 80,000 | Do. do. 6 % Cum. Pref. | 5 | 6 % | 6 % | 3 % | Nil | 3/32— 1/8 | 3/32— 1/8 | .. | .. | .. | Nil |
| 430,500 | Do. do. 4½ % 1st Mort. Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 62 — 65 | 62 — 65 | .. | .. | .. | 6 18 6 |
| $8,150,000 | Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds. | $500 | .. | .. | .. | .. | 83 — 85 | 83 — 85 | .. | .. | .. | .. |
| 10,000 | Folkestone, 1 to 10,000 | 5 | 5⅜% | 5⅜% | 5⅜% | 5⅜% | 4¾— 5¼ | 4¾— 5¼ | .. | .. | .. | 5 4 9 |
| 10,000 | Do. 5 % Cum. Pref., 1 to 10,000 | 5 | .. | 5 % | 5 % | 5 % | 5 — 5⅜ | 5 — 5⅜ | .. | .. | .. | 4 10 0 |
| 90,000 | Do. 4½ % 1st Deb. Stock | 100 | 4½% | 4½% | 4½% | 4½% | 97 —100 | 97 —100 | 98 | .. | .. | 4 10 8 |
| 15,000 | Hove, 1 to 15,000 | 5 | 8¾% | 9 % | 9 % | 8¾% | 6⅜— 6⅝ | 6⅜— 6⅝ | .. | .. | .. | 6 8 4 |
| $1,325,000 | Kaministiquia Power Co., 5 % Gold Bnds. | .. | .. | .. | .. | .. | 95 — 96 | 95⅜— 96⅜ | 96⅛ | .. | + ⅛ | .. |
| 21,000 | Kensington and Knightsbridge Electric Ord. | 5 | 12 % | 10 % | 10 % | 10 % | 7⅞— 8⅛ | 7⅞— 8⅛ | .. | .. | .. | 6 1 3 |
| 90,000 | Do. do. do. 4 % Deben. Stk. | Stock | 4 % | 4 % | 4 % | 4 % | 94 — 97 | 94 — 97 | .. | .. | .. | 4 2 6 |
| 111,000 | London Electric Supply Corporation, Limited, Ord. | 3 | 3 % | 4 % | 4 % | 2½% | 1⅜— 1⅜ | 1⅜— 1⅜ | .. | .. | .. | 3 6 8 |
| 70,000 | Do. do. do. 6 % Pref. | 5 | 6 % | 6 % | 6 % | 6 % | 4⅝— 5⅜ | 4⅝— 5⅜ | .. | .. | .. | 5 11 8 |
| 374,395 | Do. do. 4 % 1st Mort. Deb. Stk. Red. | Stock | 4 % | 4 % | 4 % | 4½% | 89 — 93 | 89 — 93 | .. | .. | .. | 4 16 9 |
| 200,000 | Metropolitan Electric Supply, 1 to 100,000 | 5 | 10 % | 10 % | 8 % | 6½% | 5 — 5⅜ | 5⅛— 5⅜ | 5 7/8 | 5 | + ⅛ | 5 15 7 |
| 76,121 | Do. 4½ % Cum. Pref. 1—71,106 | 5 | 4½% | 4½% | 4½% | 4½% | 4⅝— 5⅛ | 4⅝— 5⅛ | 98/9 | .. | + ⅛ | 4 5 9 |
| 220,000 | Do. 4½ % 1st Mort. Deben. Stock | .. | 4½% | 4½% | 4½% | 4½% | 107 —110 | 107 —110 | .. | .. | .. | 4 1 10 |
| 248,000 | Do. 3½ % Mort. Deben. Stock Redem. | Stock | 3¾% | 3¾% | 3¾% | 3½% | 85 — 88 | 86 — 89 | 88⅜ | 88 | + 1 | 3 18 8 |
| $6,000,000 | Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds | .. | 5 % | 5 % | 5 % | 5 % | 87⅛— 88⅜ | 87⅛— 88⅜ | .. | .. | .. | 5 12 8 |
| $13,585,000 | Do. Light and Power Co., Ltd., Common | $100 | .. | .. | .. | .. | 76½— 77½ | 75½— 76½ | 76⅜ | 75½ | — ⅜ | .. |
| $1,500,000 | Do. do. 7% Cum. Pref. Stk. | Stock | .. | .. | .. | .. | 105 —107 | 105½—107½ | 107 | 106⅜ | + ⅜ | .. |
| $12,000,000 | Do. do. 5% 1st Mtg. Gold Bnds. | .. | .. | .. | .. | .. | 89½— 90⅜ | 89½— 90⅜ | 90⅜ | 90 | .. | .. |
| 250,000 | Midland Electric Corporation, 4½ % 1st Mort. Deb. | 100 | 4½% | 4½% | 4½% | 4½% | 95 — 98 | 95 — 98 | .. | .. | .. | 4 11 10 |
| 87,500 | Newcastle-on-Tyne, 1 to 87,500 | 5 | 8 % | 8 % | 8 % | 8 % | 4⅜— 5⅛ | 4⅜— 5⅛ | .. | .. | .. | 7 16 1 |
| 87,500 | Do. 5 % Pref., 1 to 87,500 | 5 | 5 % | 5 % | 5 % | 5 % | 5⅛— 5⅜ | 5⅛— 5⅜ | 5⅛ | .. | .. | 4 10 11 |
| 10,852 | Notting Hill Electric Lighting | 10 | 7 % | 7½% | 7½% | 7½% | 11⅞— 12⅜ | 11⅞— 12⅜ | .. | .. | .. | 5 17 8 |
| 20,000 | Oxford, 1 to 96 and 407 to 20,310 | 5 | 7 % | 7 % | 7 % | 7 % | 5⅞— 6⅛ | 5⅞— 6⅛ | .. | .. | .. | 5 9 10 |
| 50,000 | Do. 4 % Deb. Stock | 100 | 4 % | 4 % | 4 % | 4 % | 95 — 98 | 95 — 98 | .. | .. | .. | 4 1 8 |
| 119,694 | River Plate Elcty. Co. Ord. Nos. 1 to 120,507 | 1 | .. | .. | 2½% | .. | 1⅜— 1⅝ | 1⅜— 1⅝ | 24/3 | .. | .. | .. |
| 100,000 | Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000 | 1 | 6 | 6 | 6 | 6 | 1/16— 1/16 | 1/16— 1/16 | 20/- | .. | .. | .. |
| 194,684 | Do. do. 5% Deb. Stk. Red. | 100 | 5 | 5 | 5 | .. | 100 —103 | 100 —103 | 102½ | 102 | .. | 4 17 1 |
| 40,000 | St. James' and Pall Mall Electric Light, Ord. | 5 | 14½% | 12½% | 10 % | 10 % | 8⅝— 9⅛ | 8⅝— 9⅛ | .. | .. | .. | 5 9 |
| 20,000 | Do. do. 7 % Pref. 20,001 to 40,080 | 5 | 7 % | 7 % | 7 % | 7 % | 7 — 7⅛ | 7 — 7⅛ | .. | .. | .. | 4 18 4 |
| 150,000 | Do. do. 3½ % Deb. Stock Red. | 100 | 3½% | 3 % | 3½% | 3½% | 87 — 91 | 87 — 91 | .. | .. | .. | 3 16 11 |
| 12,000 | Smithfield Markets Electric Supply, Ord. | 5 | 4 % | 4 % | Nil | Nil | 1/16— 1/8 | 1/16— 1/8 | .. | .. | .. | Nil |
| 46,700 | Do. do. do. 4 % Deb. Stock | Stock | 4 % | 4 % | 4 % | 4 % | 68 — 72 | 68 — 72 | .. | .. | .. | 5 11 1 |
| 65,000 | South London Electricity Supply, Ord. | 4 | 4 % | 4 % | 8 % | 4 % | 2⅜— 3 | 2⅜— 3 | .. | .. | .. | 6 13 4 |
| 120,000 | South Met. Elec. Lt. & Power, Ord. | 1 | Nil | 2½% | 2½% | 2½% | ⅜— ½ | ⅜— ½ | .. | .. | .. | 3 6 8 |
| 142,968 | Do. do. 7 % Pref. | 1 | 7 % | 7 % | 7 % | 7 % | 1⅜— 1⅝ | 1⅜— 1⅝ | .. | .. | .. | 5 16 8 |
| 200,000 | Do. do. 4½ % 1st Deb. Stk. | 100 | 4½% | 4½% | 4½% | 4½% | 100—103 | 100 —103 | .. | .. | .. | 4 7 5 |
| 80,000 | Urban Electric Supply, Ord. | 5 | 5 % | 5 % | 5 % | 5 % | ⅞— 1 | ⅞— 1 | .. | .. | .. | 20 0 0 |
| 50,000 | Do. do. 5 % Cum. Pref. | 5 | 5 % | 5 % | 5 % | 5 % | 1⅞— 2 | 1⅞— 2 | .. | .. | .. | 12 10 0 |
| 275,000 | Do. do. 4½ % 1st Mort. Db. Stk. Red. | 100 | 4½% | 4½% | 4½% | 4½% | 80 — 83 | 80 — 83 | .. | .. | .. | 5 8 5 |
| 800,000 | Victoria Falls Power Co., Pref. Nos. 1 to 800,000 | 1 | .. | .. | .. | .. | ⅜— ⅝ | 37/32— 39/32 | 17/6 | .. | — 1/32 | .. |
| 110,000 | Westminster Electric Supply, Ord. | 5 | 14 % | 13 % | 12 % | 10 % | 8⅛— 8½ | 8⅛— 8½ | 8⅜ | 8⅛ | .. | 5 12 8 |
| 81,279 | Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905) | 5 | 5 % | 5 % | 4½% | 4½% | 5 — 5⅛ | 5⅛— 5⅞ | 5 11/16 | 5 7/16 | + ⅛ | 4 1 10 |

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

**Bank rate of Discount 2½ per cent. May 28th, 1908.**

## THE BALANCING OF A THREE-WIRE DIRECT-CURRENT NETWORK.

By B. SANKEY, Borough Electrical Engineer, Whitehaven.

THE balancing of the two sides of a three-wire D.C. network, especially in small towns, is a problem which often presents considerable difficulties in practice, and the writer offers the following suggestions as the outcome of his experience of several systems of recording and arranging the balance on a three-wire system.

Owing to the large diversity factor of the different classes of consumers, it is evident that consumers cannot be indiscriminately balanced one against the other according to the number of their equivalent 8 or 16-C.P. lamps, as is often done, nor does it follow that because the bus-bar pressure at the station is equal on both positive and negative bars, and there is no neutral current returning to the station, the same equality of pressure and current exists on all sections of the network.

In order to record simply and effectively the balance of any particular street or mains section, it is desirable to divide the consumers into not less than three distinct classes, and to balance each class separately. Three convenient classes are :—

1. *Early-hour consumers*, which include offices, banks and business places generally, whose premises are seldom lit after 5.30 or 6 p.m., and rarely on Saturdays or Sundays.

2. *Evening consumers*, which includes shops and churches, whose lighting hours in small towns are usually not later than 8 or 9 p.m., and on five days of the week only.

3. *Late-hour consumers and miscellaneous.*—This class includes hotels, houses and other late-hour consumers, motors and others generally, which are not included in classes 1 and 2.

For convenience and adaptability, the card system lends itself most readily for this purpose, and a differently tinted card is used for each class, or three tints in all.

Between each set of three cards an indicator card shows the street or section of distributor to which the consumers are connected, and the cards may be further divided into feeder sections corresponding to the sections into which the network is divided.

**BALANCING CARD.** SECTION A

DISTRIBUTOR Lowther St. From King St. box to Queen St. box.

| + Totals. | + Lamps | Name of consumer. | Class. | No. | — Lamps | — Totals. |
|---|---|---|---|---|---|---|
| | | A. Jones | Shop lighting | 21 | 14 | |
| | 8 | H. Smith | „ „ | 124 | | |
| | 10 | R. Sutton | Shop lighting | 130 | | |
| | | F. Smith & Co. | Shop lighting | 142 | 10 | |
| | | „ „ | „ motor | „ | 33 | |
| | 25 | —— Church | Church lighting | 160 | 10 | |
| 111 | 68 | „ „ | Organ motor | „ | 68 | 135 |
| | 7a | Wed., Oct. 5/07 (early closing). | | Time, | 8 p.m. | 5a. |
| | 15a | Sat., Oct. 8/07 | | Time, | 8 p.m. | 12a. |

8 in.

CARRIED FORWARD

5 in.

A diagram of a suitable balance card is given above, the reverse side being also the same; on this the consumer's name is first entered, next the class of supply, *i.e.*, house, shop or church lighting or motor, and adjacent to this his number as entered in the various cards and ledgers of the department.

The equivalent number of 8 or 16-C.P. lamps is then entered in the + or — lamp column of the tinted cards (1), (2) or (3) according to the class of supply to which the consumer belongs, and the polarity of his service.

In the case of a motor connected across the outers, the equivalent lamps are entered half on each side.

The lamp columns are each totalled up and the totals entered in the totals column from time to time as alterations or additions are made.

In some cases it may be possible to take readings on certain sections of the distributors, and in this case the actual amperes can be entered on the cards, together with the date, day of the week and hour, and these readings will form a most useful reference if taken at regular intervals.

In order to keep this system accurate and up to date, it is desirable that every two or three years an inspection should be made of each consumer's installation on a distributor section, and a new set of cards made out showing the alterations made in the equivalent lamps by reason of the introduction of different sizes or types of lamp on the original installation; the old cards, being of no further use, are destroyed and replaced by the new. Extensions to existing installations are booked separately, and can be shown by prefixing (*a*) and (*b*) before the two entries of the consumer's name.

This system, so far as the writer has been able to discover in actual use over a number of years, provides for every possible combination of circumstances, and will ensure as well-balanced a three-wire network as it is possible to get, with a minimum of trouble in recording, and handy for quick reference.

## METER-READING BOOKS AND CONSUMERS' LEDGERS.

By J. C. PETERSEN, A.C.I.S., Chief Clerk and Commercial Assistant, Corporation Electrical Supply Department, South Shields.

### METER-READING BOOKS.

THE utility of the Card Index System for record keeping has been proved beyond doubt, and there can be no question but that a considerable amount of valuable time will be gained, and a more efficient method obtained, if the Card Index System is adopted by the Meter-Reading Department.

There are many disadvantages in the use of the ordinary bound Meter-Reading Books, one in particular being that as new consumers are connected to the mains, space is not always at hand for the records to be placed in their proper order; consequently, the data have often to be placed at the back of the book or in some other available space, with the result that should any of these particular readings be required, in the absence of the meter readers, by some other official who is not thoroughly conversant with the arrangement of the book, a considerable amount of time is wasted before the desired information can be obtained. Further, as the new consumers increase the fast-leaf book grows more and more into an utter state of chaos; the readings are scattered here, there, and everywhere except where they should be, that is, in their proper order of route, so that the readers on their journeys always have the next consumer's records before them. A further disadvantage will, moreover, be discovered in the use of the fast-leaf book, if ever it is necessary to set on at once a new reader: however well he may be acquainted with the district, he will certainly miss consumers who are not in proper order in the book, and will not discover this fact until he arrives at the page or pages with the records thereon, which consequently necessitates a considerable portion of the ground being gone over twice.

It may be suggested that this difficulty is surmounted by leaving three or four blank pages after each consumer's records for future consumers; in that case there are in use three or four times more books than are necessary, and further, some lots of the three or four pages will be filled up before others, and the state of chaos again commences.

These remarks apply particularly to electric light undertakings, owing to their continual growth.

All these difficulties can be obviated by the introduction of the card system. The cards should not be kept loose in the tray, but in loose-leaf books, capable of holding, say, 50 cards each, 30 cards only at first being inserted in each book, which makes allowance for 20 additional consumers per book. Strong cardboard backs, with brass eyelets in

the centre, through which a small tagged lace is inserted, can be bought for a few pence each. Unless a special tray is obtained, the guide rods will have to be dispensed with, the lace holding the cards in position.

The books should all be arranged in route order, numbered, and placed in the trays in numerical order. The first book in the tray should contain an alphabetical index; ruled cards are inserted as required, and the names of the streets should be indexed alphabetically, with the number of the book such street or streets are contained in.

Thus, if the data regarding any particular premises are required, on reference to the street index the number of the book can be at once ascertained, and the records immediately

METER READINGS.

No. Premises.

| Name | Date | Meter Size | Demand | Index | Read by | Remarks |
|---|---|---|---|---|---|---|
| | | | | | | |

Heading of Card.

turned up. In the case of a consumer's readings being required whose address is not remembered, reference should be first made to the consumer's index, and the street ascertained; from the index in the meter-reading tray, the information will be obtained, enabling the consumer's card to be turned up.

As time goes on, these books, in spite of their expanding nature, will reach their limit; the cards can then be easily rearranged by transferring to additional books. Say No. 1 book contains its limit—50—take 25 out of No. 1 and place in a new book, and so on; this will again allow for another considerable expansion. The books should then all be renumbered; small gummed labels should be used for this purpose, placed in numerical order, and the street index rewritten. The time occupied in doing this is so little that it needs no consideration, and without doubt such little time will be gladly afforded whenever the books require rearranging owing to that desirable result—the great increase of consumers.

If at any time it is found not desirable to renumber all the books or rewrite the index, which, however, is a small matter, by reason of there being only one or two books reaching their limit, then additional books can be added numbered 1·1 or 2·1 as the case requires, and the street index written up accordingly.

It might also be stated here that all cards should be kept in their proper order in the book, whether premises are consuming energy or not, and meter readers should call on these premises on their rounds, thus discovering any damage to meters, &c.; these systematic calls would further have a tendency to prevent the fraudulent use of energy.

Before concluding this section on meter-reading books, it might be added, in case any objection is made to the system owing to the possibility of the lace wearing through the holes in the cards, and the cards consequently becoming loose in the binders, that the writer has known these cards in use for over three years, and this objection has not shown itself in actual practice; however, if from any unforeseen cause a card should be mutilated to such an extent as to require renewing, a new card is easily inserted, the consumer's name and address, together with the index at the last reading, being all that it is necessary to put on the card, as the particulars on the old card will all be contained in the consumers' ledger.

### Consumers' Ledgers.

A further considerable saving of time can be effected, and a most efficient and methodical system obtained, by the introduction of the loose-leaf ledger for consumers' accounts, this ledger being particularly adapted for this class of account keeping.

The accounts should be arranged in route order, and a numerical index used corresponding with the index of the meter-reading cards; that is, accounts under "Tab 1" should coincide with the cards contained in meter-reading book "1," and so on. There is no necessity for any indexing, as the street index in the meter-reading card tray answers for both tray and ledgers, and reference can be made to any account in the manner already described in connection with the meter-reading books.

If, however, it is desirable to have the street index for the ledgers separate from the meter-reading tray, an alphabetical index can easily be arranged at the beginning of ledger No. 1, for all the consumers' ledgers in use, and the numerical interleaved index thereafter arranged as before described.

The accounts in the ledgers being arranged in the same order as the meter-reading cards, the ledger clerk's work is straightforward, page after page; the saving in time here is obvious, as, with the fast-leaf system, each consumer is given a number, and the accounts are kept in numerical order, irrespective of the order in which they appear in the meter-reading books, so that the clerk has to turn from one part of the ledger to another. Further, if busy with, say, No. 1 ledger, he abstracts all particulars from the meter-book he is using, relating to that particular ledger, and then again abstracts from the same meter-reading book all accounts belonging to No. 2 ledger, and so on, until the particulars in that meter-reading book are all duly entered in the various ledgers; then commences a repetition with the new meter-reading book, or where the number of the staff will permit, the meter-reading books are handed from clerk to clerk for posting the records into the different ledgers, and again in this case there is the constant turning from one part of the ledger to the other, and, further, the wading through the meter books, picking out the information required for the particular ledger.

In a large supply undertaking having some thousands of consumers, and consequently a number of consumers' ledgers in operation, the saving effected by the method suggested would be considerable.

## NOTES ON PATENT LICENCES AND MANUFACTURING AGREEMENTS.

### With Special Reference to Engineering and Electrical Work.

By THEODORE RICH.

Recent legislation with regard to patents has made the subject of patent licences and agreements a matter of great interest to manufacturers and engineers in this country, and the object of these notes is to give some idea of the features necessary for the drawing up of satisfactory working agreements, and of the difficulties that are likely to be met with in practice.

Patents can be divided into three main classes:—

I. Patents which cover some improvement in the design and arrangement of manufactured products—such as electrical machinery, engines, boilers, pumps, &c.

II. Patents covering some improvements in the manufacture of products in factories or workshops, such as processes in electro-chemistry, metallurgy, foundry work and general engineering, which do not to any degree affect the nature of the work turned out, but mainly the facilities of manufacture and the cost of the finished product.

III. Patents which affect the product both during and after manufacture, the nature of the new material leading to a number of new developments in construction; among this class might be placed improvements in the manufacture of rubber and other insulators, steel and chemicals.

The electrical and engineering manufacturer generally deals with patents in Class I, the general manufacturer and chemist with Class II, and the civil engineer with Class III.

When dealing with the subject of patents, it should not be lost sight of that the inventor takes out a patent primarily for the purpose of making money, and the licensee takes up the patent for a similar reason, though inventors do not always realise this elementary fact. The reasons that have prevented manufacturers in this country from taking up certain patents in the past, have not necessarily been their lack of enterprise, sagacity or patriotism (reasons given so often in the popular Press), but the improvement may not

prove suitable for the home and Colonial markets at their disposal, or the free market that they can obtain may prove too restricted in demand to warrant the capital outlay that is nearly always necessary for the development of a new machine or tool. Owing to the peculiar conditions ruling on the Continent, inventors and manufacturers there frequently ask for fees out of all proportion to the profit likely to be obtained in this country.

One of the first questions raised between patentee and manufacturer, is that of the exclusive or non-exclusive licence; it is also a question of importance to settle whether a foreign or other licensee shall have selling rights in the markets covered by the manufacturing licence.

In Great Britain it is the general practice, especially with patents of Class I, or patents affecting the design of machinery, to ask for exclusive licences, these licences covering, where possible, the Colonies.

On the Continent it is the exception to grant one firm exclusive licences over any extent of territory, and, therefore, it is usually a difficult matter to negotiate sole manufacturing and selling rights with a Continental patentee. It is quite a common occurrence for a patentee in, say, Berlin, to grant licences to firms in Westphalia and Bavaria, as well as in Prussia, or in Bohemia and Hungary, as well as in Austria, the licensees being at liberty within limits to compete with one another in the home markets, and in most cases quite freely in the export extra-European markets.

On the Continent there is nearly everywhere a strong local feeling due largely to political and racial divisions, the local manufacturer getting much greater preference than in England; this feeling is assisted by the fact that the factories are generally founded, owned and supported, by local financial institutions, the institution and not the public finding the money required for contract or development work.

These industrial banks and financial groups frequently control industries not merely in the neighbourhood but in all parts of the world; this control is not limited to the manufacturing alone, but also applies to the output of the manufactured product itself.

If a patentee on the Continent were to give an exclusive licence to any one firm or financial group, he might find a large part of the market cut off, owing to the fact that the various consumers tend to buy their supplies and machinery from firms in their own group. It is quite a common matter for a controlling group to guarantee a certain minimum output to a factory, the owners being saved a large part of the expenses of introducing and advertising a new machine on the market.

This action is also assisted by the close co-operation between the home and foreign Continental banking houses, the Government, and the diplomatic service.

The above remarks apply to a large extent to the United States, where it is quite usual for various factories to use their patents in common, the controlling interests making the necessary financial arrangements.

The British manufacturer, on the contrary, has to face competition from all sides; the local feeling in the way of contracts is very weak, the average buyer not giving more than 2½ per cent. preference to the local or home manufacturer, if as much, and there are practically no controlling financial groups to influence business or assist in times of stress. A sole licence should therefore be obtained, to act as a guarantee for the heavy initial outlay required for putting new plant on the market.

There is many a case on record where a home manufacturer has taken up a Continental or American patent, and has spent time and money on pushing the business, only to find himself at a later date in competition with the original patentees, the owners having retained selling rights, and obtained business at the expense of the original introducers.

Continental patentees have, in the past, lost a good deal of business in England owing to their attempting to grant licences broadcast, refusal to grant exclusive licences, and at the same time asking much higher fees than the normal English trading profits will allow; to such an extent has this been the case, that several important patents have failed to obtain a footing, and others have only begun to be developed a year or so before the expiration of the patent.

A great objection to the non-exclusive licence is that it is a difficult matter to prevent competition between licensees, as it must be remembered that, unless the product is one in very general demand, undue competition means low profits, and this will tend to prevent the licensees from pushing the sale, and cause them to look out for other methods for obtaining the desired results.

Even where strict selling agreements for the regulation of prices have been drawn up between licensees, it will frequently be found that some parties to the agreement have obtained orders by quoting for auxiliary or other plant not covered by the patent at absurdly low prices, or by offering terms of payment or special facilities which cannot be covered by an agreement.

In several instances where home firms have taken up a foreign patent, one licensee has quoted low prices or short deliveries, obtained orders, and then imported the bulk of the plant from the original manufacturers, passing the plant through the home shops as a matter of form, and has thus cut out competitors working on more legitimate lines.

It is necessary when arranging patents to insist on the right to take up any improvements of the original patentees or manufacturer at a reasonable figure. Where the patent is paid for on the percentage basis, the increase for improvements should be small, as not merely is the useful life of the patent lengthened, but any great improvement reacts favourably on the licensee and also on the profits of the patentee, due to the increased turnover. It sometimes happens that a firm has taken out an improved patent, reserved the same to itself, come into the market on the strength of the goodwill of its original licensees, informed buyers that the machine on the market is of an obsolete pattern, and regained a large part of the business that the licensees have paid for.

In cases of improvements by licensees, it is usual to arrange for the original patentees to have the use of the same without paying fees, but where the patentee is not a manufacturer, it is hardly equitable for competing or foreign licensees to have the use of the improvement without some payment or obligations.

The above remarks *re* exclusive licences apply especially to patents of machines or processes, as a whole, and not so much to improvements in detail, which can be applied to machines in general demand on the market. In the latter case, an exclusive licence would frequently prove disadvantageous to the patentee, especially when the subject matter of the patent is somewhat weak. The general, or open, licence is arranged largely for patents in electrical windings, instruments, arrangements of cables or wiring, and parts or fittings of engines, boilers or condensers, where an open licence spread over the market at a reasonable rate, will prove more profitable to an inventor than an exclusive licence at a higher rate with a restricted market.

It should be noted that when an improvement in a machine or process has got a hold on the market, it will frequently pay a manufacturer to give a reasonable fee to the inventor or exploiting syndicate and obtain the advantage of his experience and advertising goodwill, even when it is generally credited that the patent would not stand up in a court of law.

The results of litigation in matters of this kind rarely compensate for the trouble and loss of prestige which takes place.

On the contrary, where the owners of a weak patent have demanded extravagant fees and conditions, and refused to throw the manufacture open to the trade, the trade in general has combined, and the patentee has lost not merely his patent and fees, but heavy law costs as well.

There are three methods of payment for patent rights in general practice:—

(*a*) The patent rights may be bought out for a given sum down. This makes the business highly speculative for the manufacturer, and the practice is more suitable for an operating financial syndicate. It should be remembered that the useful life of a patent is well within the statutory 14 years, and that towards the end of the life of a successful patent, competing machines or articles are generally put on the market to obtain the results for which the patented machines have created the demand.

Many patents for non-engineering products, even when comparatively successful, have a useful life of two or three

years only, owing to the rapid changes in fashion, though it must not be forgotten that fads and fancies rule nearly as much in engineering circles as in the social world.

There have been in the last few years temporary crazes on such subjects as power gas, electric transmission, electrification of railways, and so on; crazes which have led to a multitude of patents, and many manufacturers have been badly hit by assuming that these crazes were permanent.

Investors in patent-exploiting companies should remember that an investment of this kind is of the nature of a short-term annuity, and that at least 10 per cent. of the purchase price must be put by before any true profit can be shown.

(*b*) Patent fees may be paid for on a percentage basis; this is the most usual method among general machinery makers. It is of importance in agreements to make quite clear what the percentage has to be based on.

It is usual on the Continent to place large contracts for machinery in the hands of one contractor, the contractor doing a large part of the arrangement of the plant himself; whereas here it is usual to split up public contracts among a number of small contractors, and therefore the successful contractor for the main machinery may only be able to make his profit on a small portion of the work and the profits will be relatively lower.

On the Continent the maker of a patented electric generator will probably get the contract for the switchboard, cables, and frequently the steam plant, so that the influence of a patented article may reach far beyond the original machine, and therefore Continental licensees can afford to pay high fees.

It should be definitely set out in any percentage agreement whether the fees are to cover the price of the machine on rails at the works, the cost of carriage and erection, the oversea shipping charges and agents' fees, and the question of the inclusion of auxiliary plant should be gone into, as there is frequently auxiliary plant necessary to work a new machine, which is usually included in a main contract and which is not patented.

It is general practice to arrange for a minimum payment of fees to prevent the manufacturer from neglecting to push a new machine, and also to prevent him from taking up a new patent merely to prevent it from falling into the hands of a competitor.

This minimum should be progressive during the first two years, as the net profits on a patent during the development period are usually low, and large sums have to be laid out in experimental work and advertising before any new machine begins to show a profitable result, even though a similar machine may have been a success in another country or market.

Taking improvements in machinery all round, the average value to a patentee or manufacturer will not often exceed 5 per cent. of the selling price, and to greatly exceed this amount the improvement must be of exceptional value.

(*c*) Payment by quantity, without special reference to cost or selling price. This method of payment is specially suitable for process patents, such as improvements in the manufacture of metals, coke, chemicals, where payment is made at so much per ton, non-exclusive patents for electrical machinery, engines, boilers, condensers, and pumps, where payment is so much per kilowatt, I.H.P., sq. ft. of heating and cooling surface, and gallons per hour, or inch diameter respectively. This method is also useful for small fittings, such as arc lamps, electricity meters, boiler mountings, &c.

A great advantage of this system, where there are a number of licensees, lies in the simplicity of the accounts, as firms then need not show details of their prices and books (which many people naturally object to do), but only details of the quantity turned out.

In cases of exclusive licences, where the patentee is able to give the manufacturer material assistance in starting the business, or where there is likely to be a valuable goodwill for the business connection in later years, it is not uncommon to arrange for the payment of fees after the patent has expired. This is quite an equitable arrangement, provided that the sum paid is not so high as to handicap the manufacturer and influence the selling price at a time when the work is thrown open to the whole trade.

When taking out a licence, it is an important matter to settle on the countries where sole rights are to be held, and also the countries where the plant may be supplied in competition with other licensees.

It frequently happens that a manufacturer takes out a licence for Great Britain, and after a few years' working, finds the demand in a restricted market to be insufficient to make a large turnover, and he wishes to do business in countries where he may have developed a connection in other lines of work, or where competitors are doing work. It is then found that, by the terms of his licence, he is forbidden to export or do work in these countries, whereas, at the commencement arrangements, exclusive or non-exclusive, could have been arranged on reasonable terms.

When going into the question of the validity of a patent, it is usual to assume that the results of a search among the Patent Office records of various countries will go a long way towards deciding on the validity or otherwise, but it must not be forgotten that many improvements never reach the Patent Office, and others can only be found described in the transactions of the various technical societies and in the technical Press—sources of information frequently neglected by patent agents and examiners.

Local conditions and customs have a much larger influence on design and manufacture than is generally realised; patents and manufactures which are most successful in England are frequently failures on the Continent, and *vice versa*.

The above remark applies not merely to patent questions, but also to international manufacturing agreements, based on the furnishing of calculations or designs, not covered by any patents. Arrangements of this character are frequently found to be of greater value to firms as an advertisement, or as a means of reducing competition, than they are of permanent assistance in working. One frequently finds that after two or three years the original form of a patented or manufactured article has become entirely changed in certain countries owing to local practice, prejudice, and other circumstances.

For the above reason internationally-organised companies with a common management are rarely a great success, owing to the difficulty of the managers of the parent company in understanding the conditions and requirements of the countries in which they have established factories and started to work patents. When going into the merits of Continental design or construction, it should be noted that complexity in construction and arrangement is esteemed rather than otherwise. This is owing largely to the fact that designers there are not accustomed to spend as long a time in the shops as in England or America, and are not in as close a touch with the outside or operating staff as is usual with us.

One can frequently see on the Continent complex machines and attachments, which, though very clever and interesting in themselves, can only save a few shillings in a year, and cannot, under ordinary circumstances, pay a reasonable percentage and depreciation on first cost.

The greater cost of labour in the States makes the value of a number of labour-saving appliances out of proportion to their first cost.

With regard to the exploitation of patents of British origin, it should be remembered that a large proportion of the technical men on the Continent have been educated in Germany and Switzerland, and are, therefore, prone to work to the principles taught in the technical schools in those countries, where it is too often assumed that British construction, practice and technical education are out of date.

It is, therefore, a matter of great difficulty to get Continental engineers to look into the merits of any English machines or processes, but it is to be hoped that, as more foreign students are coming into this country to study every year, this prejudice will be reduced as time goes on.

With regard to the exploitation of patents in the States, it should be noted that over there the value of a patent depends not so much on the merits of the patent itself as on the power or influence of the financial organisation standing behind it.

It is possible in the States to take out a preliminary claim in general terms, and lodge the final claim some years later

when somebody else has worked the matter out, the genuine inventor being squeezed out of his property.

A European inventor should place his business in the hands of a reliable local agent, and get the work taken up by one of the big financial organisations, as their adverse influence is frequently sufficient to prevent any material business being done, or if the invention shows signs of being a success, these organisations are sufficiently powerful to start manufacture on their own account without any great fear of the consequences.

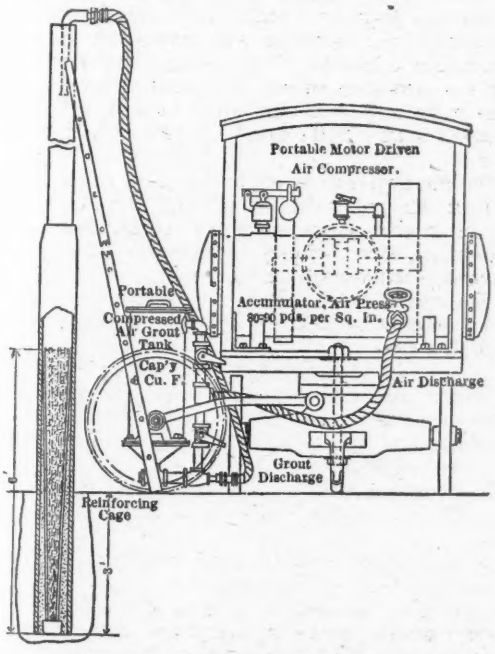
As a result of the unsatisfactory state of patent affairs in the U.S.A., a large number of successful European patents remain undeveloped.

With regard to the taking-out of patents in general non-manufacturing countries such as South America, Australia, and the Far East, it is usual for inventors and manufacturers, acting largely on the advice of patent agents, to spend large sums in taking out patents in all countries. This is frequently a mistake, as if patents are taken out in the leading manufacturing countries, and the terms of the licences are arranged with care, it will not pay a buyer to set up a local manufactory solely in order to get round the patents.

The above notes have been got together primarily for the assistance of inventors and manufacturers, to enable them to form a starting point for negotiations. Many of the principles laid down may seem to be of an obvious and commonplace character, but many manufacturing agreements have been drawn up in the past in the enthusiasm of the moment, without due appreciation of the complications which frequently arise in trade. Lack of care in details of this character has frequently led to difficulties, if not open hostilities, in the past between inventors and manufacturers, which could have been easily prevented.

## THE TREATMENT OF CORRODED TRAMWAY POLES.

We are in the habit in Great Britain of judging the condition of a steel tramway pole from what can be seen without trouble, and the idea that these poles are liable to the




Method of Reinforcing Steel Poles.

weakening influences of corrosion from various sources has not been treated very seriously. Probably the American tramway engineers were equally sceptical until hard facts stared them so boldly in the face that it was impossible for them to close their eyes to the danger any longer. One of the largest tramways in the States has determined recently to save several thousand poles from destruction by the novel use of reinforced concrete, which is applied in the manner indicated in the sketch, taken from a recent issue of the *Electric Railway Journal*. First a cage built of high-carbon twisted steel bars, with the lower end set in a concrete-iron base, is forced to the bottom of the pole and stands up 2 ft. or 3 ft. above the ground level. The top of the cage is allowed to flare outwards like the ribs of an umbrella, but the bars are kept from contact with the pole by distance pieces. Grouting is then pumped into the pole by means of compressed air, which forces it through a line of armoured hose. The whole process is the work of a few minutes only.

British engineers should begin a stage earlier than the Americans, by doing what they can to prevent corrosion.

## ELECTRICITY SUPPLY IN THE TROPICS.

By COLONIAL.

The writer of this article was responsible a few years ago for the erection of an electricity supply station in the tropics, and for its subsequent running. As some of the difficulties met with do not present themselves in European countries, it may interest your readers to give some account of the problems met with.

The first operation which required attention was the unloading of the plant from the steamer. In England it is usual to deliver boilers, engines, generators, &c., on railway trucks or special road wagons drawn by traction engines at the main doors of the station, where the travelling crane takes hold of them, and drops them in the required position. This condition of affairs did not obtain in the outlying part of the Empire where the station was situated. In order to convey the boilers, which were of the loco. type, from the wharf to the station, it was necessary first to construct cradles of stout timber joists to enable them to be moved along on rollers. The boilers were lifted from the hold by means of the steamer's derrick and winch, and deposited on these cradles. They were then taken in hand by a gang of 50 to 60 lusty natives, and in the course of a day or two were moved to the station. Towards the end of the work, the natives became quite expert in picking up the rollers as they came out behind, and dropping them in front. The engines, generators, &c., did not cause so much trouble as the boilers, as they were packed in strong iron-bound cases. When the plant had been deposited inside the station, the difficulties were only just beginning ; there was no travelling crane, and the only method of lifting was by means of jacks. When the engine beds were ready to receive the engines, these were brought alongside, raised by jacks to the required height, and then slid along greased iron rails over the foundation bolts, the operation being finished by lowering the engine again by the use of jacks.

Luckily it was possible to obtain men with a fair amount of training in engine fitting and erection, as there was a considerable supply of marine engine drivers and stokers.

It was when one began the electrical part of the work that one's worst troubles commenced. The only native who could be credited with the faintest trace of electrical knowledge was a worthy who had erected a telephone system serving no fewer than six subscribers, five of whom on the average were unable to use this method of communication owing to so-called temporary faults, which had a peculiar knack of lasting for months !

The mains for the supply of current for the street lamps consisted of bare hard-drawn copper wires fixed overhead on porcelain insulators carried by brackets on steel poles. It was not anticipated that there would be any great difficulty in the erection of the poles, but even this apparently simple operation was beyond the untrained native. The poles as erected assumed any position but that of the normal to the earth's surface, and it did not seem possible to instil into the native mind the conception that an angle of 100° was not equal to one of 90°. However, this trouble was surmounted by the exercise of a considerable amount of patience, and the

stringing up of the wires began. In parts of the routes which were lighted there were several distinct circuits carried on the same pole. It was, therefore, essential that there should be no contact between the various wires, which involved all the latter being pulled up to approximately the same tension. A great deal of long and careful supervision was necessary before even tension was secured, and the strain of continually gazing upwards whilst directing operations needed to be felt to be justly appreciated.

The street lighting mains were the first part of the distributing system to be erected. From the experience gained during the erection of these, it was decided that owing to the effects of tornadoes with the accompanying violent lightning discharges, falling trees, &c., it was advisable to place underground the mains for the lighting of public and private buildings. The soil in the locality, which was on the coast line, consisted of almost pure sand, and the level of many of the streets was very little above high-water mark. Consequently as soon as one excavated to a depth of a foot or so, water was met with. The pits for the reception of section, branch and service boxes were first built of brick in the ordinary way, but it was found that they immediately filled with water, which in many cases penetrated into the junction boxes and caused serious trouble. To overcome this difficulty, the writer decided to construct the boxes in one piece, which he proceeded to do as follows :—A wooden frame or mould was constructed and liquid concrete poured in. The concrete was allowed to set and thoroughly dry, which was not a long process, with the sun temperature at 180° F. When perfectly dry, both inside and out were treated with hot tar, and after such treatment the boxes were found to be practically proof against continual immersion in the water.

The cable was taken in through holes in the side of the boxes, so arranged as to form a stuffing-box, which was filled up solid with bitumen. Underground chambers for the reception of transformers were built on the same lines, and proved very satisfactory, as the heat given off by the transformer evaporated any trace of moisture. It is possible that the method above described may be of use to engineers in this country who have to carry their distribution mains through water-logged soil.

Having described a few of the troubles encountered during the erection of the plant and mains, the writer now proposes to give some idea of the running of the station. The station staff, which consisted entirely of natives, was selected with the greatest care, as on this selection depended the success, or otherwise, of the undertaking. No difficulty was experienced in obtaining fairly efficient stokers and engine drivers from the ranks of natives who had served their apprenticeship on steamers or launches, but when one came to the switchboard control, candidates for the post were distinguished as much by their diffidence as by their ignorance of the duties. The switchboard, in the native mind, was considered as a kind of high altar from which at any moment lightning or flames might suddenly emerge to destroy the unlucky attendant. The native telephone expert above described was at last induced by a subtle appeal to his *amour propre* to take charge of the switching, and after he had survived for some weeks all the dangers which were supposed to be inseparable from the position, other candidates plucked up courage to offer their services. The writer's nights during the first months of the running of the plant were not spent in uninterrupted repose. Whenever anything unexpected took place, the attendant promptly fled from the switchboard and surveyed the same from a safe distance, in the meantime sending a message for help.

One night in particular stands out in his memory. A messenger arrived with a slate on which was written, "Please Sir, there is magic in the wires"; rather an extraordinary message to receive from a switchboard attendant. On investigating the cause of the magic, it was found that on a perfectly calm night part of a huge tree had suddenly fallen across a route along which several circuits ran, and brought the whole lot down. It was discovered, curiously enough, that the reason for this sudden fall was the enormous crop of fruit which the tree was carrying, the weight of which split the trunk in twain. Naturally such an occurrence caused considerable fluctuations in the various feeder ammeters.

It does not appear possible by the most forcible presentation of the case, to impress the native staff with the absolute necessity for every member to remain awake during his shift, and it was frequently the writer's privilege, when paying surprise visits to the station, to find most, if not all, the members of the staff in the arms of Morpheus, totally oblivious of the risk of burning the crowns out of boilers or ruining all the lamps on the mains by excessive pressure.

In conclusion, a few remarks will be made as to the effect of lightning. Tornadoes in the tropics are accompanied by discharges of electric current of an intensity of which residents in temperate zones have little conception, and though every precaution is taken to protect the distributing mains, it is difficult to provide entirely against breakdown.

Naturally the steel poles themselves, the tops of which were several feet higher than the conductors, constituted one safeguard; but in addition to this, all feeders were connected in the station to arresters of the Wurtz type before reaching the switchboard.

During a tornado these arresters presented quite an interesting spectacle, as the sparking between the cylinders was most vivid, and was accompanied by reports resembling pistol shots.

On several occasions, in spite of all safeguards, sections of the conductors, which were of No. 10 S.W.G. H.D. copper, were completely fused, but the arresters were so effective that no damage was ever done to the insulation of the generators. This may possibly have been due to the fact that choking coils for the regulation of the voltage were inserted in all the overhead feeder circuits.

One strange effect of a specially severe storm should be mentioned. As already stated, the mains for the supply of current to public and private buildings were laid underground: they consisted of concentric cables drawn into earthenware ducts, the outer conductor being at approximately earth potential.

The supply was single-phase alternating current, the transformers being, in some cases, in special chambers, and in some cases in the buildings to be lighted. All transformers had both their primary and secondary windings protected by means of fuses, which, in the case of the primary, were enclosed in glass tubes.

On the occasion in question, not only was the insulation of the cable pierced in several places, but the fuses were vaporised, the glass being deposited in the form of a fine white powder on the covers of the cases.

The fact that the cable was concentric would appear to preclude the explanation of induced currents, and the only suggestion that occurs to the writer is that the copper plate between the two windings, being efficiently earthed, acted as a means for the discharge of a static charge induced in the conductors of the cable.

## POWER AND HEATING GAS FROM BITUMINOUS COAL.

Some very interesting statistics in regard to the gasification of bituminous coal were given at a meeting of the American Society of Mechanical Engineers on October 13th, 1908, by Elbert A. Harvey.

Although numerous inventors have devised apparatus for the gasification of bituminous coal, which might appear to have solved the problem which is most prominent in the minds of all gas engineers, the small number of installations in successful operation is evidence that there are numerous conditions to be taken into account and provided for before their general application will compete with the use of anthracite and coke.

At the conclusion of his paper, Mr. Harvey expresses the opinion "that the successful making of clean gas suitable for gas engines and small furnaces from bituminous coal and for continuous operation has been established beyond question."

However, the statistics given indicate that instead of attempting to decompose the tarry matter by passing it through the incandescent fuel, &c., the volatiles are allowed to pass off along with the carbon gases and the heavy hydro-carbons are removed by special apparatus. The apparatus described is that known as the "Industrial" gas equipment, and includes the recovery and utilisation of the tar. That the coal employed was of a quality containing a large proportion of volatile gases may be judged by the composition of run of mine Indiana coal, quoted as having the following proportions:—

| | | | | |
|---|---|---|---|---|
| Moisture ... ... ... | 6·65 | per cent. | | |
| Volatile matter ... ... | 36·75 | „ | | |
| Fixed carbon ... ... | 50·35 | „ | } | coke. |
| Ash ... ... ... ... | 5·40 | „ | | |

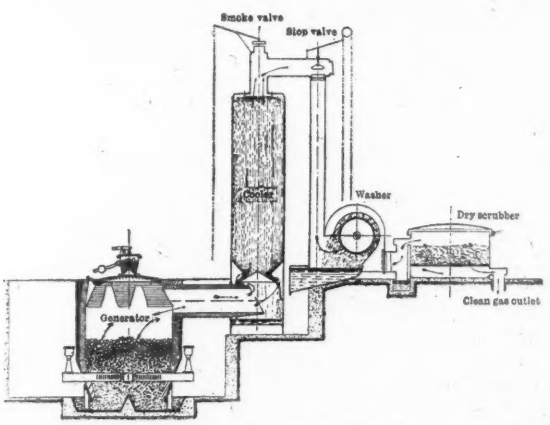
For the successful production of gas of a uniform quality from such coal, it was necessary that the generating chamber should have considerable sectional area, and be provided with poking holes to permit of frequent stirring and breaking-up of the fuel and properly distributing it over the whole area.

The producer was of the pressure type supplied with air and steam, as usual, but the bed of fuel was not maintained very deep. This class of fuel is not suitable for automatic feeding without assisting the regular descent by stirring and poking. In fact, the producer described was a development of the Siemens producer for providing gas for heating purposes.

When such producers are only employed for providing heating gas, the constancy of the quality, usually, does not receive much attention, but when the gas is to be used in engines, this is essential.

As the gas leaving the producer carries a considerable amount of condensable hydro-carbons, principally tar, it is requisite that these shall be arrested before the gas is fit for application to gas engines which are to run continuously, and the "Industrial" equipment, or some other having similar purifying qualities, has to be employed.

The circular producer is preferable to the rectangular type, for the reason that, in the latter, there is sometimes a tendency for the fire to burn through at the corners, out of reach of the poker;




SECTIONAL ELEVATION OF PRODUCER AND CLEANING PLANT.

when this is the case, the proportion of carbonic acid rapidly increases, and the thermal value of the gas falls proportionately. Four producers of 10 ft. diam. are quoted as supplying the gas for 1,320 B.H.P., which at 1·06 lb. of coal per B.H.P.-hour is only equivalent to a consumption of 4·46 lb. per sq. ft. of generating chamber area, as compared with 26·2 lb. of coke, or 23·9 lb. of anthracite in suction producers. The capital expenditure on the producer would, therefore, be proportionately increased.

Mr. Harvey instances a company operating two power plants, one on bituminous coal gas, and the other on steam. The gas plant provided 1,320 H.P. with an expenditure of fuel of 15 tons of coal per 24 hours, while the steam plant, based on equal power, required 79·2 tons in the same time. Both of these plants were operating under the same factory conditions. However, particulars of the steam plant are not given.

Mr. Harvey's carefully-prepared estimate for a 20,000-H P. electric power plant, including everything up to connections for the "departing service wire," is as follows (the author's figures being in dollars, are reduced to sterling at 4s. 2d. per dollar):—

| | |
|---|---|
| Gas engines and electric generators ... ... | £162,500 |
| Gas producers and auxiliaries ... ... ... | 41,666 |
| Building ... ... ... ... ... ... | 12,500 |
| Miscellaneous, including piping, pumps, exciters, freight, &c. ... ... ... ... ... | 12,500 |
| | £229,166 |

Cost per H.P. of equipment, £11·45.

Estimated annual cost of electric power at the switchboard, 20,000 H.P.; full continuous load, 24-hour service, 308 days per year:—

| | |
|---|---|
| Coal for entire equipment, bituminous run of mine, at 1¾ lb. per KW.-hour at the switchboard, amounting to 84,000 tons at 8s. 4d. per ton ... | £35,000 |
| Labour, including chief and assistant engineers for both shifts, and all necessary assistants, amounting to 40 men ... ... ... ... | £6,000 |
| Oil, waste and miscellaneous supplies ... ... | 5,000 |
| Overhead charges at 15 per cent. on £229,166 ... | 34,375 |
| Total cost of 95,000,000 KW.-hours ... | £80,375 |
| Cost per KW.-hour at switchboard, 0·203d. | |

The following is the analysis of the gas produced from the coal already referred to—*i.e.*, Indiana run of mine:—

| | Percentage Composition. | |
|---|---|---|
| CO ... ... | 21·47 at 324 | = 70 |
| $H_2$ ... ... | 15·29 „ 278 | = 42·5 |
| $CH_4$ ... ... | 3·58 „ 919 | = 33 |
| $CO_2$ ... ... | 8·57 | |
| $N_2$ ... ... | 51·09 | |
| | 100·00 | 145·5 |

Net B.TH.U. per cb. ft.

The author gives numerous other particulars which are of practical interest, but also open to criticism from certain points of view.

For the maintaining of a constant quality of gas manual labour in poking, &c., is depended on; the quality of gas is not of much account, provided that it is thoroughly cleaned from condensable matter, nor is the type of gas engine employed of any great importance.

The recovery of the tar is a feature of economy, which is of value in providing the steam for the producer and the power for the gas-washing apparatus.

The system employed is well illustrated by the view given in the figure, which shows a section through the producer and gas treatment apparatus. Comparing the figures given by three different installations quoted, the cost per KW.-hour at the switchboard is as follows:—

| | |
|---|---|
| Average load 263 H.P., or 175 KW., 10-hour service, 300 days per year, coal at 9s. 2d. ... ... | 9·35d. |
| Average load 1,320 H.P., or 892 KW., 24-hour service, 300 days per year, coal at 10s. 5d. ... ... | ·40d. |
| Average load 20,000 H.P., or 13,333 KW., 24-hour service, 300 days per year, coal at 8s. 4d. ... | ·20d. |

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BAHAMAS.—The following are exempt from duty:—Boilers; copper in sheets; electrical apparatus and appliances; engine packings; engines, steam, oil, gas or electric; iron rails, spikes, and parts for railways and tramways; machines, steam, oil, gas, electric or heat; pitch; rolling stock for railways and tramways; scientific instruments and apparatus; sleepers for railways and tramways; and telephones.

Electrical and other similar materials, not mentioned above, are dutiable at the general rate of 20% ad valorem; the value on which duty is collected, being the price charged to the importer for the articles at the place at which they were purchased.

NOTE.—No person may erect, construct, establish or maintain any instrument or apparatus for the purpose of transmitting or receiving messages by means of wireless telegraphy, without the consent of the Government.

BARBADOS.—The following are free of duty:—Machinery and apparatus imported for manufacturing bricks, tiles, cement, pipes, &c., sugar, rum and ice; for boring for oil or petroleum, or for mining asphalte or other minerals, for refining oil or petroleum, for manufacturing matches, tobacco, or cocoa; tar, pitch and resin; all machinery, locomotives, carriages, trucks, sleepers, iron or steel rails or manufactured ironwork imported for the construction, maintenance or extension of the railway or tramways; instruments, cables, wires and other materials necessary for the use and construction of the telegraph lines or cables of the West India and Panama Telegraph Co.; fuel for oil or motor engines on a certificate to that effect from the exporter; and electric apparatus for professional purposes imported by passengers.

| | |
|---|---|
| Cement ... ... ... ... ... ... | 1/3 per barrel |
| Copper in sheets, rods, bars, bolts, &c. ... ... | 4/2 per 100 lb. |
| All other electrical and similar materials not mentioned above ... ... ... ... | 10% ad valorem |

The value on which duty is levied is the prime cost of the goods as shown in the invoice; freight, insurance, cost of package and other expenses being included.

NOTE.—No person may establish any wireless telegraph station or install or work any apparatus for wireless telegraphy, except by permission of the Government.

BELGIUM.—Invoices and consignment notes should state the gross weight of packages and the net weight of contents, which should be fully described and the country of origin stated. When various descriptions of merchandise are packed together the net weight of each class should be stated separately. A certificate of origin is not required, but, as stated above, it is advisable to declare the origin of the goods on the various documents.

In the case of ad valorem duties, the value to be declared for payment of duty is the price of the goods at the place of origin or manufacture, increased by the charges for freight, insurance and commission necessary for the importation to the place of entry. The importer must declare separately the value of the goods contained in the package, when,

being dutiable on that basis, they are included in the same tariff denomination, and the value of some differs from that of others.

Franc = 9$\frac{6}{10}$d., or 25 francs = £1 ; kg. = 2·204 lb.

| | |
|---|---|
| Rubber, raw | Free |
| „ manufactured | 10% ad valorem |
| Scientific instruments and apparatus | Free |

This heading includes optical, mathematical and computing instruments, instruments of observation and precision, physical and chemical instruments for laboratories, surgical instruments, and instruments and apparatus constructed specially for scientific research.

| | |
|---|---|
| Machinery, implements and tools; electric apparatus, telegraph and telephone apparatus, commutators, electric meters, interruptors, accumulators, amperemeters, voltmeters, dynamo-electric machines, &c.:— | |
| Of aluminium | 40 fr. per 100 kg. |
| Of cast-iron | 2 „ „ |
| Of wrought-iron or steel | 4 „ „ |
| Of wood | 10% ad valorem |
| Of copper, or any other material | 12 fr. per 100 kg. |
| Electric submarine and underground cables, and tramway carriages of all kinds, are dutiable as machines. | |
| Machines and implements imported in an unfitted condition are dutiable according to the material predominating in weight in the fitted machine or implement, subject to compliance with certain rules. Spare or duplicate parts pay duty separately. Machines and parts thereof of copper may be entered as manufactures of copper if desired by the importer. | |
| Note.—Component parts of machines are dutiable as machines. Machines, or parts of machines, subject to different duties, are classed according to the material predominating in weight. The declarants are required to place the Customs in the position to ascertain the predominating material, under penalty of paying duty on the highest taxed material entering into the machine. | |
| Machine belting:— | |
| Of leather, rubber or similar materials | 30 fr. per 100 kg. |
| Of any other material | 20 „ „ |
| Copper and nickel, manufactured | 10% ad valorem |
| Steel plates | 1 fr. per 100 kg. |
| Iron or steel wire, coppered, nickelled, tinned, lead coated or zinced, of any diameter | 3 „ „ |
| Steel wire, plain or galvanised, less than 5 mm. dia. and of a tens. strength of at least 120 kg. per sq. mm., for the manufacture of cables and ropes | 1 „ „ |
| Iron or steel wire:— | |
| Of 5 mm. or more in dia. | 1 „ „ |
| Of less than 5 mm. dia. | 2 „ „ |
| Copper, hammered, drawn or rolled | 10 „ „ |
| Cables of electrolytic copper wire, covered with a cotton sheath, exclusively required for dynamo and transformer coils, at option of importer:—10 % ad valorem or 12 | fr. per 100 kg. |
| Electric lamps of special construction for use in laboratories | free |
| Portable electric lamps for offices, &c.; lighting apparatus consisting of a metal support, an enamelled iron reflector, and a glass globe | 10% ad valorem |
| Cylinders, sticks, lumps, &c., of carbon | 5% „ „ |
| Electro-medical apparatus: | |
| For the exclusive use of physicians and surgeons | free |
| Other | 13% ad valorem |

## NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,021. "Improved method of and appliance for preventing telephone or telegraph wires, when broken, making contact with other wires carrying higher voltages, such as traction power or lighting wires." W. S. Smith. December 12th.

27,034. "Chemical electrolytic process for cleaning metal objects to be galvanised or nickelled." H. Vollert. December 12th.

27,086. "Improvements in and connected with electric incandescent lamps." J. W. Ottley and F. Harrison. December 13th.

27,075. "Improvements in devices for attaching wire conductors to insulators." C. Schroter. (Date applied for under Sec. 91 of the Act, December 12th 1907, being date of application in Germany.) December 14th. (Complete.)

27,082. "Improved telpher railway." H. E. S. Holt. December 14th.

27,097. "Method of securing thin covering to fine angle wires." Siemens Schuckertwerke G.m.b.H. (Date applied for under Sec. 91 of the Act, December 14th, 1907, being date of application in Germany.) December 14th. (Complete.)

27,119. "Invention for improving the mouthpieces of telephones, speaking tubes and the like." H. A. Tosland. December 14th.

27,138. "Improvements in electric speedometers and odometers." H. Bonbright. December 14th. (Complete.)

27,139. "Improvements in and relating to telephone exchange systems." E. E. Clement. December 14th. (Complete.)

27,140. "Potentiometer for measurements on alternate-current and direct-current circuits." C. V. Drysdale. December 14th. (Complete.)

27,142. "Improvements in and relating to railway switches." M. W. Griffin. (Date applied for under Sec. 91 of the Act, December 14th, 1907, being date of application in United States.) December 14th. (Complete.)

27,143. "Arc lamp with pairs of carbon arranged tangentially to the axis of the lamp." D. Tomar and K. von Dreger. December 14th. (Complete.)

27,144. "Process for the production of pure and thin filaments of any length for illuminating purposes." A. Kroll and B. Saklatwalla. (Date applied for under Sec. 91 of the Act, December 13th, 1907, being date of application in Germany.) December 14th. (Complete.)

27,145. "Improvements in and relating to electrical wiring of houses and the like." J. S. Highfield. December 14th.

27,149. "Improvements in driving mechanism for dynamos." H. Leitner. December 14th.

27,156. "Improvements in electric heaters." F. W. F. Ross. December 14th.

27,168. "Switch for closing and opening an electric circuit." O. Baker. December 15th.

27,207. "Improvements in or relating to time switches." A. Raasch. December 15th. (Complete.)

27,212. "Mechanically-operated electric ignition regulator." C. Cecil and H. P. Bronsdon. December 15th.

27,213. "Improvements in electric switches." G. Sweetser. December 15th.

27,236. "Improvements in and in connection with electric generators." P. M. Justice. (A. W. Kiddle and A. M. Baumann, United States.) December 15th. (Complete.)

27,242. "Improvements in or relating to electrical distribution systems." J. P. Crouch and J. Etchells. December 15th.

27,244. "Improvements in or relating to electric switch mechanism." J. F. Marshall. December 15th.

27,283. "Improvements in alternating current meter." H. Landis and K. H. Gyr, (trading as Landis & Gyr). December 15th. (Complete.)

27,303. "Improved feeding mechanism for arc lamps." C. E. G. Gilbert "Cantley." December 16th.

27,310. "Improvements in telephony and telegraphy by means of Hertzian waves." F. J. Chambers. December 16th.

27,323. "Automatic timing switch." F. W. W. Baker and G. Pearce. December 16th.

27,343. "Improvements in or relating to alternating-current meters." Siemens Schuckertwerke G.m.b.H. (Date applied for under Sec. 91 of the Act, December 17th, 1907, being date of application in Germany.) December 16th. (Complete.)

27,389. "Improvements in mouth pieces of speaking tubes and telephones." H. James. December 16th.

27,434. "Electric curling tongs." M. W. Buller. December 17th.

27,436. "Electric signalling apparatus." A. T. Blackall. December 17th.

27,444. "Improvements in incandescent lamps." P. Schanz. December 17th.

27,462. "Improvements in or relating to generating electric currents." N. Tanka, R. Wanibuchi and A. R. Peacock. December 17th. (Complete.)

27,469. "Improved electrical leakage detector and indicator." T. H. Thuburn. December 17th.

27,470. "Improvements in the manufacture of insulated line wire cables for telephone circuits and the like." W. S. Smith and W. P. Granville. December 17th.

27,477. "Improvements in connection with third rail insulators." P. M. Justice. (Essex Co., United States.) December 17th. (Complete.)

27,491. "Improvements relating to electrical machines." H. Barta and F. G. French. December 17th.

27,504. "Improvements in electrical fuse boxes." W. Zumpt. December 18th.

27,512. "Improvements in and relating to electric treatment for curative and other purposes." H. Wartmann. December 18th. (Complete.)

27,523. "Improvements in shade devices for electric lamps." C. W. Frauenlob. December 18th. (Complete.)

27,536. "Improvements in arc lamps." A. Holman. (Date applied for under Rule 13, September 1st, 1908; an invention comprised in Application No. 2,261 of 1908, dated February 1st, 1908.) December 18th. (Complete.)

27,538. "Improved tool for severing the hard metal sheathing of electric conductors." J. J. Rawlings, H. W. Handcock and A. H. Dykes. December 18th.

27,539. "Improvements in and connected with the sheathing of electrical wires." J. J. Rawlings, H. W. Handcock and A. H. Dykes. December 18th.

27,554. "Improvements in apparatus for operating railway switch points and signals." A. H. Johnson. December 18th.

27,577. "Improvements in fuse setting machines." F. Wigley, R. Redpath and T. A. Petrie. December 18th.

27,585. "Improvements in incandescent electric lamps." P. Good and C. H. Davies. December 18th.

27,616. "Brake for electric tramway cars, locomotives, motor-cars, and all road vehicles." A. Priestley and G. A. Priestley. December 19th.

27,624. "Electro-plating barrel apparatus." T. A. Smith and T. Deakin. December 19th.

27,626. "Mechanical appliance for showing variation of temperatures, with electrical alarm attachment." T. R. Walton and R. H. Bell. December 19th.

27,635. "Improvements in insulators applicable to wheeled vehicles and other purposes." W. P. W. Weatherill. December 19th.

27,639. "Improved means for attaching shades and reflectors to incandescent electric lamps." C. W. Dawson. December 19th.

27,664. "Improvements in and relating to devices for electric heating." F. A. Wilkinson. December 19th. (Complete.)

27,684. "Improvements in contact voltmeters or the like." H. Leitner. December 19th.

27,685. "Improvements in means for reversing the connections of dynamo-electric machines." H. Leitner. December 19th.

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### 1907.

Electro-Magnets. P. Pinckney. 18,441. August 15th.

Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co., United States.) 22,868. October 16th.

Enumeration of Telephone Calls. S. D. Williams. 24,165. November 1st.

Interlocked Ironclad Electric Switches. V. Hope, V. H. Sugden and W. H Gardner. 25,585. November 19th.

Commutating Devices for Electric Machines. M. Walker. 25,624. November 19th.

Processes of Manufacturing Bodies Capable of Conducting Electricity in a Cold State. E. von Seemen. 25,655. November 19th. (Date applied for under International Convention, November 19th, 1906.)